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State of Pennsylvania,

FOR THE

PROMOTION OF THE MECHANIC ARTS.

DEVOTED TO

MECHANICAL AND PHYSICAL SCIENCE, CIVIL ENGINEERING, THE ARTS AND MANUFACTURES, AND THE RECORDING OF AMERICAN AND OTHER PATENTED INVENTIONS.

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JANUARY, 1852.

CIVIL ENGINEERING.

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*Extract from the Report of the General Board of Health respecting the Metropolis.—Water Supply and Drainage of Towns.**

The Board have inquired fully into that essential point—What are the qualities of water the most conducive to health, and to economical employment for domestic and manufacturing purposes?

On this question the Board refer to a great mass of evidence; and first, as to the effect of lime contained in water.

It cannot be gathered from the evidence that, excepting in calculous disorders, a small quantity of lime in water has been *proved* to be injurious to health, though it has always been suspected of being insalubrious, and is thought to be so by many of the witnesses.

The Report states that Professor Clark has invented the term of *degrees of hardness;* this will doubtless be found to be of great practical convenience. One degree of his lime scale, as it may be called, denotes that one grain of carbonate of lime is contained in a gallon of water; the several higher degrees of hardness denote that for as many as are the degrees marked, so many are the grains of carbonate of lime contained in each gallon of water.

That lime injures water for all economical purposes is fully proved, as also for most manufacturing processes, "but the natives of London are very little aware of it." We find no attention paid to it in any of the "schemes for water supply which have obtained the aid of parochial Boards."

Hardness is unfavorable to all culinary operations; thus, according to

* From the London Mechanic's Magazine, for September, 1851.

M. Soyer's evidence, hard water gives a yellow tinge to vegetables boiled in it, and gives them a shrivelled appearance. Hard water "does not open the pores of meat so freely as soft water does." Infusions of all kinds are stronger when made with soft water than with hard; so that tea made with water of $6\frac{1}{2}$ degrees of hardness requires nearly a third less of the tea than when made with water of 16 degrees of hardness, being about that of Thames water. This evidence was corroborated by that of Mr. Philip Holland and of Professor Clark. Hard water requires more fuel than soft to raise it to a boiling heat. Hard water occasions greater expense than soft in washing, on several accounts; as the greater quantity of soap or of soda required, the extra labour in washing, the greater wear and tear of the clothes themselves. "As far as the home market is concerned," "more money is expended in washing than in the manufacture of the fabric, or of the clothes themselves." In London, "before a shirt is worn out, five times as much money as it originally cost will have been expended on it in washing." The alkalies and mineral ingredients used in washing with hard water never fully leave the clothes.

The data on which the Board calculate the expense of mere washing are the only ones throughout the whole Report that appear to be erroneous; in this instance they seem to be so, because the prices stated for washing—whether by the piece, or from the weekly average expenditure of individuals or families—are not for washing alone, but include the charge for expenses incurred in collecting linen, drying, and folding it, mangling some of the articles, ironing several of them, starch, blue, &c.; which items constitute together at least half the expense of laundry-work. The oversight in this respect does not, however, invalidate the strong testimony given of the increased cost on several accounts occasioned by washing in hard water.

From Mr. Donaldson's evidence, it appears that for every 100 gallons of water used, 2 oz. of hard soap are required to soften it for each degree of hardness; thus water of 5° of hardness requires 10 oz. of soap; if the water be of 15° of hardness, 30 oz.

The amount of the money expended for washing in the metropolis was another inquiry. According to one estimate the washing bills in London rise to the enormous sum of 5,000,000*l.* a year, at the average rate of little more than a shilling a head per individual for the whole population. This the Board seem to think excessive,—and, indeed, it appears to be so; the masters in some families may, indeed, spend even more than five shillings a week in laundry work, as specified in the calculations; but the laundry expenses of the greater portion of the industrious classes do not amount to more than sixpence a head a week,—and this description of persons form the great bulk of the metropolitan population.

Soft water is more agreeable and effective than hard for baths, and for all purposes of the toilette. Several witnesses affirm that, as a beverage soft water is more agreeable than hard; though those accustomed to hard water become reconciled to its use.

There are many manufactures that cannot be advantageously carried on with hard water; hence several of the great London brewers have, at a heavy outlay, caused deep wells to be dug on their premises for the purpose of obtaining water that is soft.

The water of the Thames supplied to London is stated to be of from 14 to 16 degrees of hardness, and that of the other rivers and streams which contribute to the supply of London is about equally hard. The Board have had 424 different specimens of water tested; they were taken from different distant places. Water from wells and springs averaged nearly 26 degrees of hardness; that from rivers and brooks 13 degrees; that from land and surface drainage not quite 5 degrees. About 26 tons of lime are delivered in the metropolis *daily*, mixed or dissolved in the water with which it is supplied.

Professor Clark has indicated an economical means of depriving water of its carbonate of lime by means of quick lime; and Mr. P. Holland describes a mode of farther purifying it by the addition of "a little oxalate of ammonia, or of soda."

A mixture of other inorganic impurities in water, such as iron, or clay, is prejudicial for all economical purposes; but, excepting after floods, being seldom found in considerable quantity in any of the waters with which towns are supplied, little notice is taken of such impurities.

The Board's inquiries respecting organic impurities are extensive and important. By the information they have elicited, it does not appear that animals and vegetables usually inhabiting water are, whilst in a *living* state, insalubrious; but that, when in a state of decomposition, they render water containing them highly injurious to health. The evidence on this head proves the fact incontestibly. Organic matters, when in that state, produce disease taken internally as a beverage, and also when the gases arising from them are inhaled. A remarkable instance of the former is given by Dr. Gavin:—"A thirsty navigator drank of the Hackney brook, and was almost immediately attacked with cholera, and subsequently speedily died." The instances adduced are innumerable of the deleterious effects of the emanations from water rendered putrid by the decomposition in it of organic matter; but "chemistry has not to the present moment succeeded in isolating those substances, or in characterizing them by particular reactions." Water got at Hungerford market contained in a gallon above 13 grains of volatile and organic matter in suspension, besides 43 grains of inorganic matter. When that water was boiled down, it emitted a strong acid smell, and when heated, a smell like that of burning wood. Exclusively of epidemic periods, "in ordinary times it is known that troops who have drank water polluted with animal or vegetable matter in a state of decomposition are peculiarly subject to dysentery."

The *boiling* of water appears to greatly diminish the deleterious effects of such water. "There was the case of a man who lived in the Coburg-road, Camberwell parish, in a semi-detached house, in a healthy situation, and with a garden behind the premises. His wife had noticed that the water supplied to them was exceedingly bad; and having been informed that it was likely to affect the health of her family, she invariably boiled and filtered it. All kept in perfect health except the father, who objected to drink this water from its being flat and unaërated: he would still drink it as it came from the water-butt, and the consequence was that he was attacked with choleraic diarrhœa; he afterwards drank no more of it, and got well."

It is shown that lead is more corroded by pure than by impure water; but it has been unexpectedly found that filtration through sand separates the lead.

These preliminary inquiries having been gone through, as to the economical and the sanitary qualities of different waters, the next question to be considered is, From what source can London be supplied with water that shall be the most free from vitiating matters?

The Board report, that "The qualities for the water supply of the population appear to range themselves in the following order:

"1st, Freedom from all animal and vegetable matter.

"2d, Pure aëration.

"3d, Softness.

"4th, Freedom from earthy, mineral, or other foreign matters.

"5th, Coolness in delivery at a minimum temperature,—neither warm in summer nor excessively cold in winter.

"6th, Limpidity or clearness."

To the above are added, as popular tests, that all special flavor or taste in water is objectionable.

A great mass of evidence is brought forward in proof that the streams from which London is supplied with water, *before* they come to be charged with sewer-water, already contain a vast quantity of animal and vegetable matter; that it is not any one of those streams but all of them, that are polluted with it,—the Thames itself to an excessive degree. That though the Thames and its tributaries be largely derived from land-springs through chalk strata, their water is in a turbid state when delivered, much of this turbidity being occasioned by animal and vegetable matter so completely in chemical solution that the common filters will not remove it; and it appears that the water of the New River, and of the water companies generally, is also charged with impurities of the same nature.

"We must state, as our conclusions upon this topic of inquiry, that if the water of the Thames could be early protected from the sewerage of all the towns draining into it, and from the sewerage of the metropolis, —if it could be purified from animal and vegetable matter as completely as deep well water, or as some of the surface water from the chalk districts, as proposed by Captain Vetch,—we should nevertheless feel compelled, upon the evidence recited, to pronounce water of such degrees of hardness to be ineligible for the supply of the metropolis, and to recommend as we now do,—"That the water of the Thames, the Lea, the New River, the Colne, and the Wandle, as well as that of the other tributaries and sources of the same degrees of hardness, should be as early as practicable abandoned.

"Deep well-water is free from surface animal and vegetable impurities, but it has generally more of mineral impurity, and is usually unobtainable in sufficient quantity at a moderate expense."

Since the number that has been made of deep wells in the metropolis of late years, it seems certain that the supply from this source would be inadequate to the wants of London. Already great brewers have arranged amongst themselves to brew respectively on different days, so as to equalize the demands on the water-bed; it is further stated that water is higher

in the wells on Mondays than on any other days, by reason of there being no brewing on the Sunday. This difference in the level of the water-bed is felt as far from town as Tottenham.

"Seeing the disadvantages inseparable from river and well-water, attention has been directed to other sources of supply." Professor Clark states that "nowhere has there been made such important improvements in the collection and purification of water supplies as in Lancashire."

"The improvement in the collection is due to the application of the principle we have above stated; that is to say, that the nearer to the actual rain fall the water is collected, the freer it will be from adventitious impurities. The new practice in Lancashire has been to take some elevated ground,—generally sterile moor land, or sandy heath; and to run a catch water trench or conduit round the hill, midway, or as high up as may be convenient for the sake of fall, regard being had to the space of the gathering-ground. An embankment is thrown across some natural gorge, at the nearest point at which a reservoir may be formed without the expense of excavation. Into this the rain water is led, and stored, to be used in dye or print works, or for other manufacturing purposes, having in many instances been previously filtered. The economy and efficiency of these filters, which merely act as strainers, are much praised by Professor Clark. They serve to show, however, how much more economically filtration may be conducted on a large than on a small scale; and how sordid and erroneous is the administration, whether of water companies, or of local Boards, which neglects or refuses filtration of the supplies used for the general population. But until recently, with the exception of a very small proportion, the supply of towns was delivered without any previous filtration whatsoever, and more than half the supply of the metropolis is still so delivered.

"The new process of land-drainage furnishes a means for the filtration and depuration of impure water on a large scale, with considerable advantages over the larger sand strainers or common filters." "Where the drains have been tolerably well adjusted, the water from this deep drainage is seen running away perfectly pellucid. Where there happen to be two branch outfalls into one main,—the one a branch outfall from mere surface drained land, the other an outfall from thorough drained land,—the water from the thorough drained land may be seen running perfectly limpid, whilst the water from the surface drained land runs away turbid, and of the color and consistency of pea-soup, from the inorganic or organic particles which it contains."

The Board caused to be tested 424 specimens of water from different parts of the country. The results were as follows:

From wells and springs, average hardness, ...	25·86
" rivers and brooks, average hardness, ...	13·05
" land and surface drainage, average hardness, . .	4·94

The Board were early desirous of investigating what matters were taken up by water passing through different sorts of soils, but the College of Chemistry declined the task; lately, however, "the examination has been made by Professor Way, with most important results." From this examination it will be seen, that clays and loams have powers of chemi-

cal action for the removal of organic and inorganic matters from water to an extent never before suspected, and that it will be practicable to use agricultural drainage arrangements on gathering grounds, as means of filtration and more complete purification of water on a larger scale than is at present accomplished."

To be Continued.

On Ventilation by the Parlor Fire. By William Hosking, Esq., *Professor of Architecture and of Engineering Constructions at King's College, London.**

The term ventilation does not strictly imply what we intend by its use in reference to buildings used as dwelling-houses, or otherwise for the occupation of breathing creatures. To ventilate is defined "to fan with wind;" but one of the main objects for which houses and other enclosed buildings are made, is shelter *from* the wind. Inasmuch, however, as the wind is but air in motion, and we can only live in air, air may not be shut out of our houses, though, for comfort's sake, we refuse to admit it in the active state of wind. But in doing this—in shutting out the wind—we are apt to put ourselves upon a short allowance of air, and to eke out the short allowance by using the same air over and over again.

There is a broad line of distinction, indeed, to be drawn between in-door and out-door ventilation; for although the principles upon which nature proceeds are the same, the operation is influenced by the circumstances under which the process may be carried on. Whether it be on the hill-side, open to the winds of heaven, or in a close room, from which all draft of air is excluded, the expired breath, as it leaves the nostrils heated by the fire in the lungs, rises, or seeks to rise, above their level, and may not be again inhaled. Out of doors the cooler or less heated air of the lower level presents itself for respiration unaffected by the spent exhaled air, but in a close apartment, the whole body of included air must soon be affected by whatever process any portion of it may have undergone. The process by which nature carries off spent air, purifies, and returns it uncontaminated, is thus checked by the circumstances under which we place ourselves within doors. All our devices for shelter from the weather, and for domestic convenience and comfort, tend to prevent the process provided by nature from taking effect according to the intention in that respect of the Creator. We not only confine ourselves, indeed, and pen up air in low and close rooms, but we introduce fire by which to warm the enclosed air; wanting light within our dwellings when daylight fails, we introduce another sharer in the pent-up air of our rooms, being fire indeed in another form, but generally under such circumstances, that it not only abstracts from the quantity, but injures the quality of what may remain. But fire, whether in the animal system, in the grate, or in the lamp, cannot long endure the imagined limitation of air. There must be access of air—of vital air—by some channel or other, or the fire will go out.

* From the Edinburgh New Philosophical Journal, October, 1851.

An open fire in the grate must however have a vent for some of its results, or it will be so disagreeable a companion that its presence could not be endured, even as long as the most limited quantity of air would last; and the fire will compel the descent of air by the vent commonly supplied under the name of a flue—a chimney flue—to render its presence tolerable in a closed room, if a supply be not otherwise obtainable. But as the outer air at the higher level of the top of a chimney, because of the rarity of the air in and above the flue, responds to the demand of the fire less easily than the lower air, or that at and about the level of the fire; and the lower air, or air at the lower levels, forces its way in, therefore, by any opening it can find or make—through the joints of the flooring-boards, and under the skirtings—the supply passing first up or down the hollow lathed and plastered partitions, sometimes even up from the drains; and through the joints under and about the doors and windows. If these channels do not exist, as they may not when the joiners' work and the plastering are good, or when the open joints referred to are stopped up by any means, the fire smokes, and every known means of curing the chimney failing, means are sought of obtaining heat without the offending fire. Ventilation is not thought of yet.

The open fire may be made to give place to the close stove or to hot-air pipes, to hot-water pipes, or to steam-pipes—which make hot the air about them in a close room without causing drafts. But the warmth obtained in pipes is costly under any circumstances. Air does not take up heat freely, unless it be driven and made to pass freely over the heated surface; and there being little or no consumption of air, and consequently little or no draft, in connexion with heated bodies, such as close stoves and hot pipes, the heat from them is not freely diffused, and is not wholesome. There is with all the expense no ventilation.

Stoves and hot pipes are, moreover, exceedingly dangerous inmates in respect of fire. Such things are the most frequent causes, directly or indirectly, of fires in buildings. Placed upon, or laid among or about the timbers and other wood-work of hollow floors, and hollow partitions, and in houses with wooden stairs, more conflagrations are occasioned by hot pipes and stoves, than by anything else, and perhaps more than by all other things together.

Open stoves with in-draft of air warmed by being drawn quickly (when it is drawn quickly) over heated surfaces, may be made part of a system of safe and wholesome in-door ventilation; but to be perfect there must be also out-draft with *power* to compel the exit of spent or otherwise unwholesome air. But the arrangements for and connected with such stoves are special, and therefore costly, unless the buildings in which they may be employed have been adapted in building to receive them. And in-draft stoves may, however, be applied with great advantage as it regards the general warmth and ventilation, in the lowest story of any house, if there be compelled out-draft at the highest level to which it will naturally direct itself if it be not retained, so that the in-drafted air, tempered as it enters, may be drawn out as it becomes spent, or otherwise contaminated.

But this must be considered in all endeavors to affect in-door ventilation, or the endeavor will fail. *The air must be acted upon, and not be*

left, or be expected, to act of itself, and to pass in or out as may be desired, merely because ways of ingress and egress are made for it. Make a fire in a room, or apply an air-pump to the room, and the outer air will respond to the power exerted by either by any course that may be open to it, and supply the place of that which may be consumed or ejected; but open a window in an otherwise close room, and no air will enter; no air can enter, indeed, unless force be applied as with a bellows, whereby as much may be driven out as is driven in, with the effect only of diluting, not of purifying. Even at that short season of the year in which windows may be freely opened, unless windows are so placed as to admit of the processes of out-door ventilation being carried on through them by a thorough draft from low levels to high levels, open windows are not sufficient to effect thorough in-door ventilation. There must for this purpose be in every room a way by which a draft can be obtained, and this draft must take effect upon the most impure air of the room, which is that of the highest level. The chimney opening may supply a way at a low level, and a draft may be established between it and the window, but the air removed from the room by such a draft is not necessarily the spent or foul air. But make an opening into the chimney flue near the highest level in the room, that is to say, as near as may be to the ceiling, and if a draft be established between the window and the flue by this opening, the ventilation is complete; that is to say again, if there be draft enough in the chimney flue from any cause to induce an up-current through it, or if there be motion of the external air to drive the air in at the window and force an up-current through the flue.

Windows may not be put open in the long enduring colder season, however, and for the same reason in-drafts of the outer air by any other channel are offensive and injurious. To open a door for the sake of air is but a modification of opening a window, and, if the door be an internal one, with the effect of admitting already enclosed, and, probably, contaminated air. Means of efficient in-door ventilation must therefore be independent of windows and doors; and the means should be such as will lead to a result at once wholesome and agreeable.

Many plans have been suggested, and some have been carried into effect, of warming air, and then forcing it into or drawing it through buildings, and, in the process of doing so, removing the foul or spent air from the apartments to which it may be applied. Some of these plans are more and some are less available to wholesome and agreeable in-door ventilation, but even the best are rather adapted to large apartments, such as those of hospitals, churches, theatres, and assembly-rooms, than to private dwelling-houses in which the rooms are small and labor and cost are to be economized.

Plans have been proposed, too, for the economical ventilation of dwelling-houses; but they seem to be all in a greater or less degree imperfect. Ways of access are provided in some cases for the outer air directly to the fire in every apartment, to feed the fire, and indirectly to ventilate the room; way of egress in addition to the chimney opening and the chimney flue being sometimes provided for the spent air of the room; sometimes, indeed, as before indicated, by an opening into the chimney

flue near the ceiling. A direct in-draft of cold air is not agreeable, and it may be pernicious, but if the outer air become warm in its way to the inmates of the room, the objection to its directness ceases. If, however, the warmth is imparted to it with foulness, the process does not fulfil the condition as to wholesomeness, and this is the case, when the outer air is admitted at or near to the ceiling to take up warmth from the spent and heated atmosphere of the higher levels. Having undergone this process, it is not the fresh air that comes warmed to the inmates, but a mixture of fresh and foul air that cannot be agreeable to any inmate conscious of the nature of the compound.

The endeavor on the present occasion was to show how the familiar fire of an apartment may be made to fulfil all the conditions necessary to obtain in-door ventilation, to the extent at least of the apartment in which the fire may be maintained, and while it is maintained.

A fire in an ordinary grate establishes a draft in the flue over it with power according to its own intensity, and it acts with the same effect, at least, upon the air within its reach, for the means which enable it to establish and keep up the draft in the flue. The fire necessarily heats the grate in which it is kept up, and the materials of which grates are composed being necessarily incombustible, and being also ready recipients and conductors of heat, they will impart heat to whatever they may be brought into contact with them.

It is supposed that the case containing the body of the grate is set on an iron or stone hearth in the chimney recess, free of the sides and back except as to the joints in front. Let all communication between the chamber so formed about the back and sides of the grate and the chimney flue be shut off by an iron plate, open only for the register flap or valve over the fire itself. External air is to be admitted to the closed chambers thus obtained about the grate by a tube or channel leading through the nearest and most convenient outer wall of the building and between the joists of the floor of the room, to and under the outer hearth or slab before the fire, and so to and under the back hearth in which sufficient holes may be made to allow the air entering by the tube or channel to rise into the chamber about the fire-box or grate. Openings taking any form that may be agreeable are to be made through the cheeks of the grate into the air-chamber at the level of the hearth. In this manner will be provided a free inlet for the outer air to the fire-place and to the fire, and of the facility so provided the fire will readily avail itself to the abolition of all illicit drafts. But the air in passing through the air-chamber in its way to the fire which draws it, is drawn over the heated surfaces of the grate, and it thus becomes warmed, and in that condition it reaches the apartment.

An upright metal plate set up behind the openings through cheeks of the grate, but clear of them, will bend the current of warmed air in its passage through the inlet holes, and thus compel the fire to allow what is not necessary to it to pass into the room; and if the opening over the fire to the flue be reduced to the real want of the fire, the consumption of air by the fire will not be so great as may be supposed, and there will remain a supply of tempered air waiting only an inducement to enter for the use of the inmates of the apartment. An opening directly from the

room into the flue upon which the fire is acting with a draft more or less strong, at a high level in the room, will afford this inducement; it will allow the draft in the flue to act upon the heated and spent air under the ceiling, and draw it off; and in doing so will induce a flow of the fresh and tempered air from about the body of the grate into the room.

The mode thus indicated of increasing the effect of the familiar fire, and making it subservient to the important function of free and wholesome ventilation, is not to be taken as a mere suggestion, and now for the first time made. It has been in effective operation for six or seven years, and is found to answer well with the simple appliances referred to. But it is the mode and the principle of action that it is desired to recommend, and not the appliances, since persons more skilled in mechanical contrivances than the author professes to be, may probably be able to devise others better adapted to the purpose.*

The mode referred to of warming and ventilating apartments by their own fires is most easy of application, and in houses of all kinds, great and small, old and new, and as the warmth derived from the fire in any case, comes directly by the in-drafted air, as well as by radiation of heat into the air of the apartment, fuel is economized. If the register flap be made to open and shut, by any means which give easy command over it, so that it may be opened more or less according to the occasion, and this be attended to, the economy will be assured; for it is quite unnecessary to leave the same space open over the fire after the steam and smoke arising from fresh fuel have been thrown off, as may be necessary immediately after coaling. The opening by the register valve into the flue may be reduced when the smoke has been thrown off, so as to check the draft of air through the fire, and greatly to increase the draft by the upper opening into the flue, to the advantage of the ventilation and to the saving of fuel, while the heat from the incandescent fuel will be thereby rather increased than diminished.

Moreover the system being applicable in the cottage of the laborer, as fully and easily as in the better appointed dwellings of those who need not economize so closely as laboring people are obliged to economize, the warmed air about the grate in a lower room may be conveyed directly from the air-chamber about the grate by a metal or pot pipe, up the chimney flue, and be delivered in any upper room next to the same flue and requiring warmth and ventilation, the process of ventilation applied to the lower room being applicable to the upper room also.

The indicated means by which winter ventilation is obtained are not of course equally efficient in summer, for the draft of the fire is wanting; but the inlet at the low level for fresh air, and the outlet for the spent air at the upper level continuing always open, the heat which the flue will in most cases retain through the summer aided by that of the sun's rays upon the chimney top, secures a certain amount of up-draft, which is not without its effect upon the in-draft by the lower inlet even when windows and doors are shut.

While it is obvious that the air drawn into any house for the purpose

* The appliances used by Mr. Hosking will be found more fully described in his "Healthy Homes," published by Mr. Murray.

of in-door ventilation need not be other than that which would enter by the windows of the same house, it may be necessary to enter into an inquiry as to the condition of the air heretofore spoken of as fresh and pure. "Fresh" and "pure" applied to air must be taken to mean the freshest and purest immediately obtainable, and that will be the same whether it be drawn in through a grated hole in a wall, or by a glazed opening closed by it in the same wall. But it is a fair subject for inquiry, whether,—speaking in London to Londoners,—the air about our houses in London is as pure,—or as free from impurity—as it might be.

The out-door ventilation of large towns may be taken to be more complete above the tops of the houses and of their chimneys than it is, or, perhaps, can be among and about the houses. The processes of nature are there not only unchecked, but are in fact aided by the heat thrown up by the chimneys into the upper air, and impurities which can be passed off by chimney flues, will be more certainly and more effectually removed and changed by Nature's chemistry, than if they are kept down to fester under foot and to exhale in our streets and about our doors and windows.

At this time every endeavor is made to provide for removing from our dwellings all excrementitious matter, and all soluble refuse, by drains into sewers, and so by the sewers to some outfall for discharge. The drain necessarily falls towards the sewer, and the sewer again to its outfall, and the sullage or soil drainage being rendered liquid thus passes in the usual course. But the usages and the necessities of civilized life cause a 'arge proportion of the liquid refuse from dwelling-houses to pass off in a heated state, or to be followed by hot water arising from culinary processes, and from washing in all its varieties. The heat so entering the drains causes the evolution of fetid and noxious gases from the matters which go with, or have gone before, the hot water; and with these gases house-drains almost always, and sewers commonly stand charged. They are light fluids, and do not go down with the heavy liquid matters from which they have been evolved, but they seek to rise, and constantly do rise in almost every house through imperfections or derangements of the flaps and traps which are intended to keep them down, but which only, when they do act, compel some of the foul air to enter the sewers, and there to seek outlet to the upper air, which they find by the gulley gratings in the streets.

It can hardly be said perhaps that *too much* attention has been given of late to the scour of sewers by water; but it is most certain that too little attention has been given to the consideration last stated, for nothing has been done to relieve the drains and sewers of their worst offence. The evolution of foul and noxious gases in the *drains* is certainly not prevented by scouring the *sewers*. In the meantime the poison exists under foot, and exudes at every pregnable point within and about our houses, and it rises at every grating in our streets, though the senses may become dull to them by constant suffering.

Now this is an evil which can be greatly ameliorated, if it cannot indeed be wholly cured; but it is by a process that, to be effective, must be general, and, therefore, it must be added compulsory. The process is of familiar application in the ventilation of mines, and particularly of

coal mines. An up-cast shaft containing a common chimney flue carried up at the back of every house, and connected with the house-drains at their highest level, would give vent to the foul air in the drains, and discharge it into the upper air. The foul air evolved by heat expands, and expanding it rises, and rising it would be followed by cold air settling down by the gulley gratings in the streets, thus constituting their inlets downcast shafts, and the sewers and drains themselves channels for the currents setting to the up-cast shafts, by which they would be relieved. The down draft into the sewers would carry with it much soot and fine dust, which would settle upon the liquid current and pass off with it, and so remove some of the tangible as well as the intangible impurities before referred to, from the air in our streets and about our houses.

Much in this way might be effected by the aid of causes in constant operation; but if the up-cast shaft to every house were also a fire-flue, or were only aided by the draft of a neighboring fire, the up-current would be sufficient not only to prevent the house drains from retaining foul air, but the foul air would be thrown off into the upper air with better effect, and be dissipated innocuously and without offence, instead of steaming as it now does from the sewers into the air where it cannot be avoided.

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*Description of Mr. Brunel's Bridge over the Wye.**

In the Exhibition is a model of a new kind of bridge, between a suspension and a tubular bridge, in the course of construction to span the river Wye, at Chepstow, invented by Mr. Brunel, the engineer of the South Wales railway.

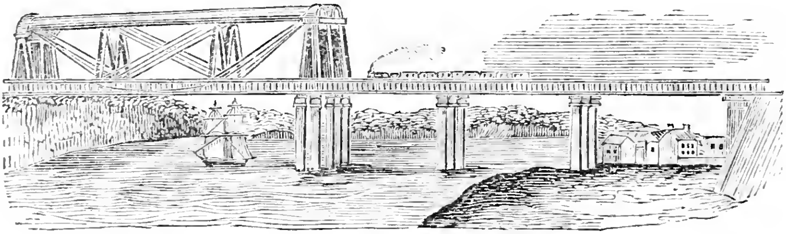
Every one knows what the Britannia bridge is across the Menai, at Bangor. It consists of two rectangular tubes, each of which has for the sake of strength, a sort of cellular or double top and bottom. The strongest and most essential part of this bridge is said to be the top. Mr. Brunel's Wye bridge is, as far as regards the roadways, two tubes without the tops. But to supply the tops he has, for each roadway, a hollow cylinder of iron suspended some distance above the roadway on piers. From the extremities of the cylinder on the piers, a chain loop runs under four pins on each side of the roadway for the purpose of helping to support it. Besides these loop chains there are two strong upright braces, one on each side, tying the iron cylinder to the outsides of the roadway, and from the top of each of these side braces to the bottom of the other another chain is drawn. Neither the utility nor the action of these brace chains have we been able to discover. But the loop chains are ingeniously contrived to give strength to the bridge with the least weight to the supporting cylinders. For by the loop chains coming from the points where the cylinders rest on their supports, if we suppose the tensile forces acting on each chain according to the rules of mechanics to be resolved into two, one pressing perpendicularly on the supports, the other must be in the direction of the cylinder, that is, endeavoring to compress it lengthwise, and therefore is in a direction which the cylinder is best able to sustain.

* From the London Railway Journal, No. 644.

With regard to the ties or braces before mentioned, and their diagonal chains, we have our doubts of their utility. They appear to us to be useless, while the braces or ties, should the bridge yield to the weight, will sink the middle of the cylinder with them, and consequently weaken it to sustain the opposite compressing forces of the loop chains at the extremities.

The span of the bridge is 290 feet; the height of the roadways 70 feet above high water mark. On the east or English side, the roadways rest on a rock, and on the Chepstow side on six upright iron cylinders, tapering, we believe, a little towards the bottom, and filled with concrete. Towards the west the roadways are continued, supported on cylinders filled with concrete, in the shape of a viaduct, for about 300 feet more, but without the sustaining cylinders. Each of the two roadways is independent of the other.

The *tout ensemble* of the bridge is light and elegant, as we judge from a model of it in the Exhibition. Externally it will have a much better effect than the tunnel tubes across the Menai, and will be more pleasant to the passengers from being open. Sailing up or down the Wye, the bridge will form a pretty addition to the picturesque scenery. It is now in the course of structure, and will probably not be completed for 12 months onwards. The total length of the bridge and viaduct is 623 feet; the clear water span for vessels 290 feet, with a headway of 70 feet at spring tides. The cylinders are 50 feet above the roadways. Beneath we give a drawing of the bridge as it will appear when finished, with the adjacent country.



AMERICAN PATENTS.

List of American Patents which issued from November 11, to December 2, 1851, (inclusive,) with Exemplifications by Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

21. For an *Improvement in Cheese, Butter, and Bread Cutters;* Benjamin F. Adams, Bangor, Maine, November 11.

Claim.—"What I claim as my invention is, the arrangement of the circular revolving table and knife; the said knife being attached to the sliding shaft, and operated by means of a treadle and weighted cord and pulley, or other equivalents, so that the cheese or other article to be cut may be placed upon the table, and not removed until, by a single revolution of the wheel, and a few slight pressures of the foot upon the treadle, it is cut into as many parts as may be desired, without crumbling or waste."

22. For an *Improvement in the construction of Scythe Fastenings;* David Anthony, Sr., Springfield, New York, November 11.

"The nature of my invention consists in attaching the scythe to the snath, in such a manner that the point may be thrown out or in, with the greatest possible facility."

Claim.—"Having thus described the nature of my invention and the manner in which it is constructed, what I claim as my invention is, the mode of adjusting the lever by rotating the ring around its own axis, by which the point of the scythe is thrown out or drawn in, as shown and described, the upper end of the lever passing through an eye attached to the ring, the fulcrum of the lever being near the end of the snath as shown, and the scythe attached to the lower end of the lever as set forth."

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23. For an *Improvement in Hand Planes;* Benjamin F. Bee, Harwick, Massachusetts, November 11.

Claim.—"What I claim as my invention is, the application to carpenter's planes and moulding tools, of a new method of confining the iron, by a metallic apparatus, acting upon the principles of the lever and cam, in combination with the set screw, for adjusting the same, as herein described; using for the purpose, the aforesaid contrivance, or arrangement of parts, or any other substantially the same, and which will produce the same effects in like manner."

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24. For an *Improvement in Screens for Winnowing Machines;* Jonathan Bean, Montville, Maine, November 11.

Claim.—"I do not claim any part or portion of the gear, fans, or forms of the hopper, or shoe, as an original invention, as I am aware that all these have been in common use; but what I do claim as new is, the arrangement of guides and side apertures in the upper movable screen, as seen in figure 3, and the lower screen, as seen in figure 4, attached to the shoe, and which screen may be attached to any common winnowing machine, in the manner and for the purposes before described."

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25. For an *Improvement in Stave-Jointing Machines;* Daniel Drawbaugh, White Hill P. O., Pennsylvania, November 11.

Claim.—"What I claim as my invention is, the adjustable knife, in combination with the adjustable rest, as described, to adapt them to the jointing of staves for casks of different bilge."

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26. For an *Improvement in Shuttle Motions of Looms;* George W. Perry, Thompson, Connecticut, November 11.

"My invention consists in hanging the picker staves, each on two radius rods, which are attached to fixed centres, on the swords, or frame of the lay, being connected by joint pins, one at the lower end and the other at a suitable distance from it. The effect produced by this arrangement being to cause the end of the staff, which acts upon the shuttle, to move in a right line, parallel to the raceway—the two radius rods producing a parallel motion, without the aid of any other device for guiding or controlling it."

Claim.—"Having thus described my invention, I do not claim hanging the picker staff on a radius rod, as I am aware that it has been so hung, and by the aid of other devices, in connexion, a motion parallel to the raceway has been produced; but what I do claim is, hanging the picker staff, or staves, upon radius rods, having two distinct radial motions, substantially as herein set forth, for the purpose of causing the end which operates upon the shuttle to describe or make a rectilinear motion, parallel with the raceway, and with less power than has heretofore been done."

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27. For an *Improvement in Machines for Cutting the Soles of Boots and Shoes;* Joseph Steger, Roxbury, assignor to William Mitchell, Boston, Massachusetts, November 11.

Claim.—"Having thus described my improvements, I shall state my claim as follows: What I claim as my invention is, the mode or means herein above described, for insuring

the unerring turning of the knife frame, for cutting both sides of the sole; said means consisting of the notched pawl lever and spring, *y*, *y*, operating on the journal plates of said frame, substantially as herein above described."

28. For an *Improvement in Car Seats;* Ezekiel Booth and Ezra Ripley, Troy, New York, November 11.

Claim.—"Having thus described the nature of our invention, what we claim as new is, the arrangement of two levers, in a cross position, so that any required height of back may be carried and reversed, from and to either side of the seat, and secure it firmly in its position, at any required angle, substantially the same as described and represented."

29. For an *Improvement in Telescopes;* Alvan Clark, Cambridge, Massachusetts, November 11.

Claim.—"What I claim as my invention or improvement consists in combining the glasses, or glasses and diaphragms, with a sliding or eye piece tube A of a telescope, by means of a tube or slide B, perforated through its side, or sides, in such manner as to enable a person, when the said tube B, is withdrawn from its enclosing tube, to obtain ready access through the openings or perforations, to the glasses or lenses; the whole being substantially in the manner and for the purposes as described."

30. For an *Improvement in Machines for Cutting Hides;* Jacob C. Flint, Boston, Massachusetts, November 11.

Claim.—"What I claim as my invention is, the combination of mechanism for reducing dry hide to a strip, and mechanism for cutting or removing the hair from the underside of the said strip at one continued operation, substantially in the manner as described."

31. For an *Improvement in Bending Felloes;* Andrew W. Johnson, St. Georges, Deleware, November 11.

Claim.—"Having thus described the nature and operation of my invention, what I claim is, the curbs C D, in combination with the box B, or its equivalent; said curbs being constructed in the manner and for the purpose substantially as described."

32. For an *Improvement in Card Grinders;* Richard Kitson, Lowell, Massachusetts, November 11.

Claim.—"What I claim is, an instrument for grinding or sharpening wool, cotton, or other cards, made with sectorial card teeth, which are so bent at the heel, as to make the sharp edge more prominent than its opposite and broad edge, together with its application to the card that is to be ground, in such a direction as to cause the sharp edge of the teeth of the grinder to be first presented to, and enter among the teeth of the card."

33. For an *Improvement in Daguerreotype Apparatus;* Wm. Lewis, Wm. H. Lewis, and J. Lewis, City of New York, November 11.

Claim.—"We claim, 1st, The construction of a camera box, with a cross opening, or mortise, to receive a sliding frame, that carries both an object glass and the daguerreotype plate, as described.

"2d, The construction and application of a sliding frame with a division to receive a frame carrying an oblong object glass, so formed as to be placed either vertically or horizontally, as described and shown.

"3d, The construction of the slide, so as to receive, in the other division, a daguerreotype plate in a frame, such frame being pressed in place by springs, and held in place by blocks taking notches in the frame, as described and shown."

34. For an *Improvement in Coupling Railroad Cars;* Lorenzo D. Livermore, Hartland, Vermont, November 11.

Claim.—"What I claim as my invention is, the combination of a stiff car coupling,

with the ends of a couple of cars, and with the trucks under the same, substantially in the manner herein set forth, by which the cars are made to guide the trucks under them, and keep them in their proper positions on the track, to wit: in such positions, that a line drawn midway between and parallel with the truck axles, will be at right angles to any straight track, and also at right angles to the tangent of any curved railroad track."

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35. For an *Improvement in Abdominal Supporters;* Allen J. Lonsbury, Somerville, Tennessee, November 11.

"The principal feature of this invention, and upon which its utility and excellence mainly depends, consists in the peculiar form of the front plate or pubic brace, and its peculiar connexions with other parts of the apparatus."

Claim.—"What I claim as my invention is, the employment of a pubic brace of the peculiar form herein described, and as represented in figures 2, 3, 4, 5, 6 and 7, of the drawings, so as to fit the os pubis, and press uniformly upon the inguinal region, while the upper edge of the brace is bent forward, so as to effect no inconvenient pressure upon the abdomen of the wearer; said pubic brace being made of hammered leather or other tenacious material, in the manner and for the purpose herein described."

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36. For an *Improvement in Bedsteads;* Levi Newcomb, Jr., New Bedford, Massachusetts, November 11.

Claim.—"Having thus described the nature of my invention, and the manner in which it is constructed, what I claim as new is, the manner of securing the lower bedstead to the upper one, so that it may slide underneath the upper one, or drawn out from it, as described, viz: by having the clamps attached to the upper part of the foot posts of the lower bedstead, and clamps fitting in the recesses of the rails of the upper bedstead, and the rails of the lower bedstead passing through the mortise holes in the foot posts of the upper bedstead, substantially as shown and set forth."

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37. For an *Improvement in Horse Collars;* Richard Rickey, Rutland, Ohio, November 11.

"The nature of my improvement consists, principally, in having two metallic plates, connected by a joint, so as to open and close with ease, and to be secured by two levers which are attached to their upper ends, and connected by a strap; these plates constitute the frame, or body of the two pads which press on the lower part of the shoulder, but do not reach up to the shoulder blade."

Claim.—"What I claim as my invention is, connecting the sides of the breast plate by a flat joint, in combination with the levers attached to the sides of the breast plate, and rising over the neck without touching the shoulders of the animal, and connected at the top, by which means the breast plate is made adjustable to the size of the horse, substantially as herein set forth."

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38. For an *Improvement in Grain Kilns;* Isaac S. Stover, Erwinna, Pennsylvania, November 11.

Claim.—"What I claim as my invention is, the combination of the heating chamber, with the two drying beds, one above and the other below, as described."

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39. For an *Improvement in Frosting Plates of Glass;* Isaac Taylor, City of New York, November 11.

Claim.—"What I claim as my invention is, the use of a rocker containing pebbles, sand, and water, for the purpose of frosting plates of glass, or embossed work, as above described."

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40. For an *Improvement in Boot Trees;* Davis R. Hendrix, Pottstown, Pennsylvania, October 28.

"The nature of my invention consists in stretching boots or shoes, by regulating the set screws in the foot."

Claim.—"What I claim as my invention is, the set screws *m* and *n*, and plate *x*, in

combination with the screw *g*, substantially in the manner and for the purpose herein described and set forth."

41. For an *Improvement in Apparatus for Sizing and Dyeing Yarns;* Alonzo Bascom, East Jaffrey, New Hampshire, November 18.

Claim.—"Having thus described my improvements, I shall state my claims as follows: What I claim as my invention is, 1st, the conducting of yarn or thread, from section or warper beams, directly into and through the size or coloring liquids, to the pressure rollers, by a series of rollers, more or less in number, placed as nearly in contact with each other as the nature of the case will admit, the closer the better, sufficient space being allowed between the fixed rollers for the passage of the yarns or threads, thus enabling the said rollers to operate as guides to each and all the threads, to prevent them from matting or clinging together, and superseding the otherwise necessary use of reeds, raddles, or other separators.

"2d, I claim the taking or making of a weaver's lease, or series of leases, at the commencement of the process of warping or beaming of yarn or thread, on section or warper beams, and at proper intervals on the same, to correspond with required lengths of yarns, or threads, on weaving beams, and preserving the same throughout the sizing and drying; thus dispensing with the use of hacks, or lease takers, in the dresser, and the otherwise necessary stoppage of the dresser or sizer, for the purpose of tying or twisting together each separate thread."

42. For *Improvements in Printing Presses;* Thomas H. Dodge, Nashua, New Hampshire, November 18.

"The nature of my invention consists in hanging the platens and type beds of printing presses on cranks, on parallel shafts, which are so arranged that the platens and type beds are always parallel, or nearly parallel to each other, during the revolutions of the shafts."

Claim.—"Having thus fully described the nature, construction, and operation of my invention, I will proceed to state what I claim.

"1st, Hanging the type bed and platen upon cranks on rotating shafts, arranged and operating in the manner substantially as herein described.

"2d, The spring presser attached to the type bed, or platen, for the purpose of pressing the band *e*, communicating motion to the sheet, against the opposite surface of the platen or bed, and causing it to be moved at precisely the same speed as the bed and platen, substantially as described.

"3d, The arrangement for carrying and giving motion to the inking roller, consisting of the barrel P, the bars Q and *p*, the lever R, springs *r* and *t*, and band *u*, combined together and with the above type bed and platen, in the manner substantially as set forth."

43. For an *Improvement in Machines for Cutting Combs;* S. Curtis, Newtown, Connecticut, November 18.

Claim.—"Having thus described the nature and operation of my invention, what I claim as new is, the wheel B, with the cutters *t*, placed on its periphery, as described; said wheel having a rotary motion, and also a vertical reciprocating motion, in a transverse line with its axis, for the purpose of turning or cutting comb teeth, substantially as described; said motion being given the wheel by means of the cams, levers, and pawls, or their equivalents, as set forth."

44. For an *Improvement in Stove Grate Bars;* George W. Gardner, Albany, New York, November 18.

Claim.—"What I claim as new is, the manner described, of forming separate grate bars for vibrating grates, rounded at their ends, secured and working in grooves of the frame, as described."

45. For an *Improvement in Ploughs;* Henry Goldson, Greensborough, Mississippi, November 18.

"My invention consists of an implement, by means of which the surface of the earth

lying near to the cotton plants and the weeds growing therein, can be pared off in a thin slice, without injury to the roots of the plants, and thrown towards the centre of the open space between the rows."

Claim.—"What I claim as my invention is, a cotton scraper constructed as herein described, with a share and mould board, projecting from the side of the landside, opposite that to which the earth is thrown; the landside thus extending from the point of the scraper to that wing of the mould board opposite the one to which it usually extends, and the several parts being so arranged, that the landside will run deep enough to hold the implement firmly to its work, the share will pare the ground and cut off the weeds near the roots of the plants, and the mould board will conduct the same towards the middle of the space between the rows."

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46. For an *Improvement in Propellers for Machinery to be Used in Currents;* James Hardie, Victoria, Texas, November 18.

Claim.—"I do not confine myself to the exact mode of gearing herein described, as many modifications of the same may be used, and answer equally well; but what I claim as my invention is, the application for the purpose specified, of one or more levers with the floats or blades at their lower ends, against which the current acts, said levers being attached at about their centres to an adjustable frame by an universal joint as described, the upper ends of the levers being attached to cranks, by which, through any suitable gearing, motion is communicated to the shaft substantially as described."

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47. For an *Improvement in Railroad Car Wheels;* Nehemiah Hodge, Adams, Massachusetts, November 18.

"My invention consists in making a car wheel in not less than two concentric parts, and connecting these parts by vulcanized india rubber or other analogous elastic material interposed between them, whereby the annular or outer part of the wheel is insulated from the central or inner part, by a substance that will not transmit vibrations from the rim to the centre or axle of the wheel, whether such vibrations be lateral or radial in direction."

Claim.—"What I claim as my invention is, connecting the tread or rim of a car wheel to the hub or central part thereof, by means of india rubber or other analogous elastic material, such elastic material being connected with the outer periphery of the central part of the wheel by a groove on the latter or its equivalent, and to the inner periphery of the rim also by a groove thereon, or its equivalent; the india rubber holding itself in both grooves by its elasticity, and giving to the wheel lateral as well as radial elasticity, as herein described.

"I also claim the grooved segments, constructed substantially as herein described, and interposed between the india rubber and the rim, for the purpose of facilitating the insertion of the india rubber into the space between the rim and central part of the wheel, and its removal therefrom, as herein set forth."

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48. For *Improvements in Mill for Grinding and Bolting;* Jehu Hollingsworth, Zanesville, Ohio, November 18.

Claim.—"Having first fully described the nature of my invention, what I claim therein as new is, 1st, the grinding of grain or other material by means of a revolving stone or metallic roller, and one, two, or more separately adjustable concaves, whereby "*high* and *low*" grinding may be performed simultaneously, and bolting the same the instant that any particles are ground fine enough, in combination with the returning on to the roller again, all particles too coarse to be bolted through the bolting concave, so that they may be ground over again and again, until they are fine enough to be discharged; and this I claim, whether it is done by means of the revolving beaters and brushes which throw it up and through the pipe, or by any other means essentially the same.

"2d, I claim the guide or partitions in the pipe as herein described, to prevent meal from scattering endwise in its transit from the bolting concave to the roller, in combination with the adjustable aprons on which it falls, and which distributes and governs it in its passage to the discharging end, as herein described and set forth."

49. For an *Improvement in Cannon for Throwing Chain Shot;* Adam Lemmer, Newark, New Jersey, November 18.

Claim.—"What I claim as new is, in combination with the revolving head, and the bores diverging as described, the rack attached to the gun, and the worm wheel hung on the shaft, by which the gun is made to revolve or turn to the desired position, so that the chain shot may be thrown either in a horizontal or vertical line."

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50. For an *Improved Screw Propeller;* Gaspard Malo, Dunkirk, France, November 18.

"My invention consists in the employment for propelling vessels of a screw, composed of two or more series of movable vanes or wings; each series attached to a separate shaft, and the shafts placed one within the other, and provided with keys, or other equivalent means of connecting and disconnecting, so that the shafts can be turned on each other, for the purpose of placing the two or more series of vanes behind each other for sailing purposes, or at different parts of the circle, to increase the paddle surface when used for propelling."

Claim.—"And having now described the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim as my invention, is arranging two or more series of narrow blades, such as above described; each series on a separate shaft, and the shafts one within the other, and provided with keys or other equivalent means of securing them to each other. substantially as specified, so that the two or more shafts may be turned on each other, and resecured to place the series of vanes directly behind each other for sailing purposes, and at different points of the circle for propelling."

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51. For an *Improvement in Desks;* Isaac H. Norris and David Flanders, Parishville, New York, November 18.

"The nature of our invention consists in constructing the top of the desk in two parts or pieces, each of which, situated side by side, is lowered and raised at pleasure by appropriate mechanical devices therefor, so that a proper level is easily obtained for either side of the book; and further, in the employment of a jointed leaf or leaves in the front of the desk, which when bent down or in, admit of the book being brought forward, and when raised up or out, form a rest for the hand."

Claim.—"What we claim as our invention is, 1st, forming the desk top in boxes, parts, or pieces, each of which may be separately raised or lowered, as required, through appropriate mechanical devices, substantially in the manner and for the purposes shown and set forth.

"2d, The employment of hinged double leaves in the front of the desk, the same when extended forming a rest for the hand, and being made capable of closing down or in, essentially as described."

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52. For *Improvements in Railroad Switch;* David F. Phillips, Republic, Ohio, November 18.

Claim.—"Having thus described my invention and improvements in the self-adjusting and locking switch for railroads, I wish it to be understood that I am aware that the relative position of the switch with the main track, or turnout, or sideling track, has been changed by the action of mechanism attached to the cars, as well as by devices attached to the locomotive in various ways; and therefore, I do not claim changing the switch by apparatus or devices actuated by the cars or locomotive; nor do I claim constructing and operating a switch, composed of a single movable section of the main rail: but what I do claim as my invention and improvement is, the employment of the additional movable sections in combination with the sections forming the switch, whereby the lateral movement of each is halved or divided in opposite directions, and a more regular curve is produced than that resulting from the use of the single movable section or switch, and thereby insuring safety, the weight of the train of cars on one section of the switch, forming a lock to the other section, as one section cannot move without the other till the train of cars shall have passed therefrom, as herein fully set forth. I also claim the combination of the double central lever bars, with the central connecting rock shaft, having two cranks projecting in opposite directions, to which are attached the cross bars for uniting the

double sections, whereby the switch is adjusted, as fully set forth and shown in the drawings."

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53. For an *Improvement in Seed Planters;* William Redick, Uniontown, Pennsylvania, November 18.

Claim.—"Having thus fully described my invention, what I claim therein as new is, the combination of the slides *f g*, with the grooves *a*, (which "drill in" the grain,) and the cells *c e*, so that by moving the slats *f* towards the centre of the hopper, to close the communication with the grooves and open it with the cells *c*, for planting in "check rows;" or by moving both the slats *f g* towards the centre of the hopper, to close the communication between said hopper and the grooves *a* and cells *c*, and open it with the cells *e*, for planting in "step-rows;" the whole being arranged in the manner and for the purpose herein set forth and fully shown."

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54. For an *Improvement in Inserting Porcelain Teeth;* William Willshire Riley, Columbus, Ohio, November 18.

Claim.—"What I claim as my invention is, the mode of inserting teeth, by forming the concave base, and of inserting the platina pins into the base of the platina surface of the teeth in an oblique direction, and attaching them to the gum plate without stays."

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55. For an *Improvement in Stoves;* Hale R. Rose, Guilford, Vermont November, 18.

Claim.—"What I claim as my invention is, placing the damper between the fire and hot air flues, so as to control the amount of opening in each respectively, and governing the same by the expansion of the rod substantially as herein described, for the purpose of regulating the heat of the oven. I do not claim the expanding rod irrespective of its connexion with the damper, placed as described."

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56. For an *Improvement in Stove Grates;* H. J. Ruggles, West Poultney, Vermont, November 18.

Claim.—"Having thus fully described my new and improved fire chamber for stoves, &c., what I claim therein as new is, the inclined elevater for raising the back grate and coupling it with the front grate; and in combination, the connecting the front and back grates with hooks or catches, constructed and arranged substantially as above specified."

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57. For an *Improvement in Spring Saddles;* John C. fr. Salomon, Cincinnati, Ohio, November 18.

"The nature of my invention consists in making a saddle tree with a movable pommel and cantle, which are connected with the pads by link joints, and with each other by a spiral spring or springs, and a raw hide covering, forming the seat."

Claim.—"What I claim as my invention is, the movable pommel, the spiral spring or springs connecting the pommel and cantle, and the raw hide seat, all combined substantially in the manner herein set forth, making a spring seat saddle tree."

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58. For an *Improvement in Gongs;* Vine B. Starr, East Hampton, Connecticut, November 18.

"The nature of my invention consists in constructing gongs of sheet or plate iron, or steel, with a rim all round, strengthened by a ring or band, the whole being coated, having the crevices, interstices, and all unsound parts filled with a suitable alloy, say of copper and tin, for producing the desired sound or ringing tone."

Claim.—"What I claim as my invention is, making gongs of sheet or plate iron, or steel, with a rim all round, strengthened by a ring or band, the whole being coated, and having the crevices, interstices, and all unsound parts filled with an alloy of copper and tin, or any alloy of a similar nature, or compound of similar metals to what is usually called "bell metal," substantially as herein set forth."

59. For an *Improvement in Finishing and Balancing Millstones;* George Todd, St. Louis, Missouri, November 18.

Claim.—"What I claim as my invention is, the inserting the balance rine in the eye of a millstone, in the early stage of its construction, and then making use of the said balance rine, in conjunction with a chuck combined with the spindle, in completing the stone, substantially as herein set forth."

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60. For an *Improvement in Wires for Making Pile in Woven Fabrics;* Erastus B. Bigelow, Clinton, Massachusetts, November 25.

"The nature of my invention consists in combining with the flat pile, or figuring wire, employed in the weaving of looped or piled fabrics, and attached to one end thereof, a weight projecting from the lower edge, so that when such wires are deposited in the open shed of the warps, and during the operation of beating up with the lay, the preponderance of the said weight will retain the wire in the proper position."

Claim.—"I do not limit myself to any particular form or mode of attaching the weight, as this may be variously modified. What I claim as my invention is, combining with the flat pile, or figuring wire, employed in weaving looped or piled fabrics, and attached to or near one end thereof, a weight, for the purpose and in the manner substantially as described."

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61. For an *Improvement in Fastenings for Garments;* Elias Howe, Jr., Cambridge, Massachusetts, November 25.

"My invention consists of a series of clasps, united by a connecting cord, the said clasps running or sliding upon ribs formed of any suitable material."

Claim.—"Having thus described my improved mode of fastening garments, &c., I shall state my claim, as follows: What I claim as my invention is, the opening, closing, and fastening together, the two sides of a garment, or other article, by means of the clasps and ribs, operating in combination, substantially in the manner herein above described. I also claim the method of connecting the clasps, one to the other, in pairs, and in the series of pairs, by the links, cord and beads, substantially in the manner herein above set forth."

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62. For an *Improvement in Cooking Stoves;* Hosea H. Huntley, Cincinnati, Ohio, November 25.

Claim.—"Having thus fully, clearly, and exactly described and represented my improvements in stoves, what I claim therein as new are, the diving flues opening from the floor, as described, and in combination with this, the chamber for the purpose described."

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63. For an *Improvement in Cooking Stoves,* George W. Carleton, Brunswick, Maine, November 25.

"The nature of my invention consists in constructing a stove in such a manner, that it may be changed by adjusting some of its parts into an air-tight, or draft, wood, or coal cooking stove, cooking range, or a wood or coal draft, or air-tight radiating stove, or into a Franklin stove for wood or coal."

Claim.—"What I claim as my invention is, the employment of the three movable plates, C, D, E, constructed and arranged as described, viz: the plate E, being hollowed, affording a passage or flue, when not cut off by the damper, through which the heat passes, warming the ovens formed by the plates, the plates being capable of being withdrawn from the stove, or varied in a vertical position; by which arrangement the stove can be converted into an air-tight, or draft, wood, or coal cooking stove, cooking range, or a wood or coal draft, or air-tight radiating stove, or into a Franklin stove, substantially as set forth."

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64. For an *Improved Safety Apparatus for Steam Boilers;* Jonathan and John I. G. Collins, Chester, Pennsylvania, November 25.

Claim.—"First, we claim as our invention, the bent tube formed and arranged substantially as described, to contain mercury, in combination with the lever of the safety

valve, or its equivalent, and connected with the steam boiler by means of a swivel and a pillar connexion, or its equivalent, whereby the varying pressure of steam varies the actual weight upon the valve.

"2d, We also claim the combination of the connecting rod Q, and the lever O, I, and the shaft R, for connecting the mercurial gauge T, T and U, with the catch box N, and projecture O, on the catch box, whereby the mercury in the gauge T, T, being the weight, holds down the safety valve, or sets it at liberty, by the pressure of steam from the pillar E, and swivel S, S, said pillar being supplied with steam from the boiler or boilers, as described in the specifications.

"3d, We also claim the combination of the rod M, with the spiral spring upon it, and small pulley at the top of it, with the notched pulley L, for holding the catch box together, so long as the full part of the pulley L, is on the small pulley, or setting it at liberty, when that part of the pulley that is cut out comes opposite the small pulley, and thereby allowing it to ascend, as described in the specification."

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65. For an *Improvement in Ploughs;* Elijah Goldthait, Fort Wayne, Indiana, November 25.

Claim.—"What I claim as my invention is, first, the cutter C^4, or its equivalent, to separate the sward for the first furrow at a proper distance from the coulter, acted upon by the prop a^3, and lever C^5, or their equivalents.

"2d, Is the piece D^3, fastened to the heel of the mould-board, in combination with the cutter C^4, to turn wide furrows.

"3d, Is the mode of connecting the tongue and plough, respectively, to the axle, by means of the links and the loose tenon on the tongue, substantially as described, so as to allow the team to walk entirely aside from the furrow, or direct course of the plough, in ploughing prairie, marsh, or other land, with soft under strata, and make the plough run smoothly and work well; and so as also to enable the ploughman to take an extraordinarily wide furrow, with one member of the team walking in the furrow, with a common yoke, thus dispensing with the long yoke now commonly used for that purpose.

"4th, Is the rope D, and lever D^1, or their equivalents, in combination with the mode of connecting the tongue and plough to the axle, substantially as described, for the purposes set forth in the within specification."

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66. For an *Improvement in Centrifugal Sugar Drainers;* Daniel King, Brooklyn, New York, November 25.

Claim.—"What I claim is, centrifugal machines for separating fluid from other matter, constructed and operating as herein set forth, with detachable vessels containing the substance to be operated upon, irrespective of the exact mode of attachment, the number of vessels used, or their form."

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67. For an *Improved Method of Operating Rudders;* Thomas H. Mortimer and James Gardiner, Charleston, South Carolina, November 25; patented in France, June 11, 1851.

"This invention consists in certain means to be employed in vessels steered by two rudders, one on each of the stern post, for the purpose of controlling the said rudders and bringing either one into operation, while the other is stationary."

Claim.—"Having thus fully described our invention, we will proceed to state what we claim as new: We claim controlling the operation of the rudders, in such a manner as to bring either into operation while the other is stationary, by means of the pins, or studs, on their tillers, in combination with the grooves or slots, in a wheel or disk, receiving motion upon an axis, or by the equivalents of the same, substantially as herein described."

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68. For an *Improvement in the Manufacture of Door Knobs;* Orrin Newton, Pittsburgh, Pennsylvania, November 25.

Claim.—"I claim the combination and arrangement of the arms, sliding plate, springs, and lever, substantially as described, operating in the manner, or in any analogous way, for the purpose set forth."

69. For an *Improvement in Drop Presses;* Milo Peck, New Haven, Connecticut, November 25.

Claim.—"What I do claim as my invention is, the general arrangement and combination of the crank and shaft with its sweeps, moving in the same direction with the moving gear or pulley, and the ratchet wheel joined together, and running loose upon the shaft constantly in the same direction, substantially as I combine them, for the purposes herein described. I also claim the lock, in combination with its sweep and springs, and with the crank, to stop its motion not too abruptly, and to hold it until it is unlocked, by the hand or foot of the workman, substantially as described."

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70. For an *Improvement in Cider Mills;* David F. Phillips, Republic, Ohio, November 25.

Claim.—"Having thus described the portable cider-mill, I wish it to be understood, that I make no claim to originality of invention to any part of the mill, separately considered; nor do I claim as new, any part of the arrangement of the press, grinding cylinder, or hopper. But what I do claim as new is, first, the arrangement of the parallel slicing knives, in combination with the reciprocating follower, made as described, with channels and ribs on its inclined face, when used with a grinding cylinder, and concave, made and arranged as described and represented, for first slicing the apples, and then delivering the slices, successively, to the grinding cylinder, to be reduced to pumice, in the manner herein described."

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71. For an *Improvement in Shingle Machines;* Franklin Skinner, Dunkirk, New York, November 25.

"The nature of this invention consists in constructing a shingle riving and shaving machine, with such devices and peculiarities, that it may rive shingles of any required thickness, even from timber whose grain is crooked or irregular; and that will shave shingles on both sides at one motion, accurately preserving the longitudinal centres thereof, even when the grain of the timber is winding; and that will, moreover, shave shingles of a uniform thickness for a part of the length thereof, according to the option of the operator, and wedge-shaped, or tapering, for the rest of the length thereof."

Claim.—"What I claim as my invention, are, first, the peculiar form and mode of adjusting of the riving plate E, the same being self-adjusting, by means of the spring F, upon which it rests, and the end of the plate contiguous to the riving knife, being bent upward, (to accommodate irregularities in the grain of the shingle timber,) as herein specified.

"2d, The employment (in combination with a shingle shaving machine) of the rolls T, levers x, z, hanging rods X, spring k, and bent lever p, or their equivalents; the whole being arranged and operated in the manner and for the purpose herein described; the levers, rod and spring acting upon the rolls, and pressing them uniformly towards each other, for the purpose of unwinding or straightening the rived shingle, in the first instance, and the bent lever, (being operated by the motion of the connecting rod R, and acting upon the spring k,) having the effect of increasing the force or pressure of the rolls upon the shingle, (as the latter passes between them,) for the purpose of preventing the splitting of the shingle, in advance of the cutters, as they approach the thin end of the shingle, as herein set forth."

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72. For an *Improved Valve for Oscillating Engines;* Wm. M. Smith, Georgetown, District of Columbia, November 25.

Claim.—"I do not claim the circular valve, nor the manner of reversing the engine by turning the valve. But what I claim as my invention is, the arrangement of the piston valve with a ground face, in a cylindrical steam chest, as described above, by which the necessity of packing about the trunnion and plummer block is avoided, consequently saving much friction in the trunnion."

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73. For an *Improvement in Railroad Car Brakes;* Francis A. Stevens, Burlington, Vermont, November 25.

Claim.—"What I claim as my invention is, the combination and arrangement of the

levers, link-rods, and shoes, or rubbers, substantially as herein described, whereby each wheel of both trucks of a car is retarded with an uniform force, when the brake is put into operation."

Re-issues for November, 1851.

1. For *Improvements in the Screw Wrench;* Solyman Merrick, Springfield, Massachusetts; patented August 17, 1835; re-issued November 25, 1851.

Claim.—"What I claim as my invention is, combining with a wrench, in which the inner jaw slides on a bar permanently attached to the outer jaw, and making part of, or permanently attached to the handle, substantially as described, a screw thread and nut connecting the movable jaw with the said bar, between the said movable jaw and that part of the handle grasped by the operator, in the manner and for the purpose, substantially as described. I also claim the arrangement of the screw upon the two circular edges of the flat bar, in the manner and for the purpose herein described."

Designs for November, 1851.

1. For a *Design for Stoves;* J. W. Gibbs, Albany, New York, Assignor to North, Harrison & Chase, Philadelphia, Pennsylvania, November 11.

Claim.—"What I claim as my invention is, the ornamental design for a stove, as herein described, and as represented in the annexed drawings."

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2. For a *Design for Iron Railings;* Frederick Fitzgerald, Assignor to Silas C. Herring and John Ryer, City of New York, November 18.

Claim.—"What I claim as my invention is, the design, arrangement, and configuration of the several ornaments composing the balustrade and step railing, branching or leading therefrom, as represented and described."

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3. For a *Design for Parlor Stove Plates;* Apollos Richmond, Assignor to A. C. Barstow & Co., Providence, Rhode Island, November 18.

Claim.—"What I claim as my production is, the new design, consisting of the mouldings, panels, and ornamental configurations, herein above described and represented in the drawings, respectively for the top, front, and end plates of a parlor stove."

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4. For a *Design for a Hat Stand;* Charles Muller, Tompkinsville, New York, November 18.

Claim.—"What I claim as my invention is, the design and configuration of a hat stand, representing a Triton, or similar figure, holding up the branches of a plant, in the manner aforesaid, with the basin lying in a bed of leaves or flowers, all arranged substantially as above described and set forth."

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5. For a *Design for a Parlor Stove;* Ezra Ripley and N. S. Vedder, Assignors to Low & Hicks, Troy, New York, November 25.

Claim.—"What we claim is, the design and configuration of a parlor stove, substantially the same as herein described and represented in the annexed drawing."

DECEMBER.

1. For *Improvements in Looms for Weaving Bags;* Cyrus Baldwin, Manchester, New Hampshire, December 2; ante-dated August 30, 1851.

Claim.—"What I claim as my invention is, first, placing the cams upon one or more shafts, in such a manner that they can be moved, so as to change their relative position in regard to each other, with or around the shaft, if upon separate shafts, or around the shaft, if upon the same shaft, in combination with the devices, substantially such as

are herein described, or their equivalents, for releasing, changing, and holding said cams, as may be required, for the purposes set forth in the foregoing specification.

"2d, Is the pin v, on the spring f^1, in combination with the pawl, m, or their equivalents, to force back the rod d^3, and propel the wheel I, by the pin d^2, acting against the inclined sides of the notches h^2, h^3, so that the pin d^2 will fall back on the groove d^1, and allow the wheel I, to be propelled by the pin c^4."

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2. For an *Improved Hand Drill;* Wm. Bushnell, City of New York, December 2.

Claim.—"What I claim as my invention is, the combination of the helical spring with the screw upon the drill shaft, and the opening and closing nut or screw nippers, the whole being applied in the manner substantially as described, and operating for the purpose of controlling all the required movements of the drill, in the line of the axis of its revolution, in giving it the pressure upon its work, controlling the said pressure, and withdrawing it from its work, as herein fully set forth."

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3. For *Improvements in Hurdle Fences;* Cyrus C. Cole, Rushville, New York, December 2.

Claim.—"Having thus fully described my improved fence, what I claim therein is, the method of locking and supporting the same, by means of the notched sills and lock braces, as herein described."

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4. For an *Improvement in Machines for Crimping Package Papers for Soda Powders, &c.;* Carlos A. Cook, Lowell, Massachusetts, December 2.

Claim.—"What I claim as my invention is, the combination and arrangement of the surfaces, t, u, v, w, x, p, b. a, c, d, in the manner substantially as represented in the drawings, and for the purpose of folding the paper in a trough-like shape, and in other respects convenient for being filled with powder, and folded together."

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5. For an *Improvement in Railroad Switches;* William N. Raines, Thomson, Georgia, December 2.

Claim.—"Having thus described my invention and improvement, and pointed out the difference between the same and other railroad switches, what I claim therein as new is, 1st, the combination of the stationary single casting c, with the single casting or switch g, each having a guard on the inside thereof, whereby the said permanent single stationary casting c, is made to subserve the purpose of the ordinary frog and auxiliary switch, in connexion with the turn-out side of the main track, as described.

"2d, I also claim, providing the movable casting g, on the inside thereof, with a guard m, for the purpose of guiding the train of cars over the switch, in a straight line, when running in the direction of the arrow y^3, and thus prevent the cars from passing on to the turn-out rails, when the switch is in the position shown in fig. 2; the projection, or frog f, being of sufficient length, in connexion with guard m, to guide the train on to the main rail a, as described."

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6. For an *Apparatus for Propelling and Steering;* John C. fr. Salomon, Cincinnati, Ohio, December 2.

"The nature of my invention consists in forming water-ways in the rudder, and appending thereto a submerged water wheel and propelling wheel, or wheels, to be worked by a force of water through said water-ways."

Claim.—"I do not claim the peculiar wheel here used, as a water wheel and propeller; but what I claim as my invention is, the combination of the water-ways in the rudder, with a water wheel and submerged propeller, to be operated by hydraulic pressure, for propelling and steering vessels, substantially as herein set forth."

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7. For an *Improved Lock for Safes, &c.;* F. C. Goffin, Assignor to Charles J. Gayler, City of New York, December 2.

"My invention consists in arranging and combining a 'talon' with a series of tumblers,

said talon having a stud upon it, and so arranged that when the stud is within a curved slot in the tumblers, the key may act upon the talon and bolt; but when the stud is thrown out of the curved slot, and above the outer surfaces of the tumblers, the key cannot act upon the bolt; the stud therefore must be brought within the curved slots, before the bolt can be withdrawn or acted upon by the key: this arrangement effectually prevents the lock from being picked."

Claim.—"I do not claim the knobs D, D, and collars E, E, with the numbers on them, for the purpose of serving as indexes, as they have been previously used; neither do I claim a series of tumblers, as those described, for these have also been previously used. But what I do claim as new is, the 'talon' N, with the stud *q*, attached to it, in combination with a series of tumblers O, having curved slots *o*, in them; said talon and tumblers operating as described, viz: the talon being thrown up by the key, during the second revolution, and the stud *q*, in consequence, placed on the other side of the tumblers, the talon being held up by the catch P, the catch *y*, on the talon, bearing against the stump *z*, and preventing the bolt from being moved back or withdrawn; the talon N, requiring to be let down when the bolt is to be withdrawn, so that the stud *q*, may work or slide in the curved slot *o*, in the tumblers, and catch *y*, be free from the stump *z*, the bit of the key, in turning, acting upon the end of the talon and shooting back the bolt, substantially as described."

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8. For *Improvements in Railroad Car Trucks;* Benjamin Hinkley, Troy, New York, December 2.

Claim.—"Having thus fully described my invention, what I claim therein as new is, hanging the frame of a six-wheel truck immediately on the centres of the front and rear axles by a shank and socket, and to the centre axle by guides, in combination with horizontal diagonal or other bracing, connecting and operating said wheels, so that they may adjust themselves to any lateral curvature in the track, and at the same time allow either of the sets of wheels to pass over any obstruction, without raising the other sets from the track; and for the purpose, also, of allowing the set from which the weight is removed, to still retain its position on the track, for guiding the others, as herein fully set forth and described."

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9. For an *Improvement in Steam Carriages for Railways;* Joseph H. Moore and William P. Parrott, Boston, Massachusetts, December 2.

Claim.—"Now we wish it distinctly understood, that we do not claim the combination of a steam engine with the axles or body of a carriage; nor do we claim any arrangement of it, by which it is directly applied to a 'fixed' axle, or one so connected directly with the carriage body, that other than a rotary motion, it can have no horizontal and rocking movements independently of the same. But what we do claim as our invention or improvement is, the arrangement or arranging the steam engine directly on a *movable* truck frame of a 'long car' or carriage, in combination with arranging the boiler, or steam generator, on or in the carriage body or frame, and connecting the engine and steam generator by a flexible pipe, or pipe having a ball and socket, or other equivalent connexion or joint, such as will allow of all the necessary rotary and rocking movements of the truck frame and carriage body; the whole being substantially as herein before described."

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10. For an *Improvement in Expanding Mandrels;* Walter Sherrod, Providence, Rhode Island, December 2.

"The nature of my invention consists in the use of an arbor, having a taper screw cut upon it, on which is fitted an expanding shell, or nut, formed of segments or pieces, whose length lie longitudinally with the arbor, and which are held together by coiled springs encircling them."

Claim.—"What I claim as my invention is, 1st, the use of an expanding nut or shell, formed in segments, whose interior faces have portions of a screw thread cut thereon, which fit within and correspond with the thread of a taper screw of the mandrel.

"2d, The manner of holding together, or retaining in their places, the several segments of the expanding shell or nut, by means of a coiled spring or springs, encircling the segments, and made of sufficient length to admit of the nut expanding, without destroying the confinement or hold of the segments, as described."

11. For *Improvements in Machines for Stretching and Drying Cloth;* Thomas Barrows, Dedham, Massachusetts, December 2.

Claim.—"What I claim as my invention is, the combination of the two winding and lengthwise stretching contrivances, or stretchers, the two widthwise rotary stretchers, and the three or any other suitable number of drying cylinders, substantially as described, so as to enable a person to cause a piece of cloth to pass in one direction over and around the drying cylinders, and next in the opposite direction, as many times as may be desirable, in order to stretch, dry, and finish the same, to the extent that may be required."

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12. For an *Improvement in the Mode of Papering Pins;* Chauncey O. Crosby, New Haven, Connecticut, December 2.

Claim.—"I do not claim the crimps that the pins are inserted through; neither do I claim rolling up the paper of pins from both ends to the centre, that being old and well known. But what I do claim as my invention is, the new mode of papering pins, substantially as herein described. I claim the new manufacture of 'book pins,' formed by folding the paper in parallel folds at regular distances from each other, producing fan-like or zigzag folds, which allows the paper of pins to be closed into compact form, without rolling or winding, for the purposes herein set forth."

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13. For an *Improvement in Machines for Working Clay;* Daniel and George Duchemin, Cincinnati, Ohio, December 2.

Claim.—"What we claim as our invention is, 1st, the fixed double eccentric cams, I, I, in combination with the pitmans J, J^1, attached to the slides K, K^1, and by means of L, L^1, giving motion to the pawls M, M^1, and through them to the rack Q, and the wheel E, for the purposes herein set forth and described.

"2d, We claim the particular arrangement and combination of machinery set forth and described in figs. 2, 3, and 4, in combination with the tempering wheel E, fig. 1, especially the double eccentric I, I, and the pitmans or connecting rods J, and J^1, the slides K, and K^1, with the pawls M, M^1, the connecting bar O, the shifting rod P, and the rack Q, as applied to tempering clay, for making brick, or any other purpose, or any equivalent device or arrangement of machinery, for accomplishing the same purpose, substantially in the same manner."

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14. For an *Improvement in Tailors' Measures;* James Maginnis, Lockport, New York, December 2.

Claim.—"What I claim as my invention is, the gauge designated by the letters A and S, in the drawings; this gauge has two arms slit through the centre, from the cross bar down, as illustrated by fig. 1, in the drawings; the front arm extends up and forms a semi-circle over and around the top of the inner arm; this semi-circle is slit through the centre, and forms a way for the two shoulder straps, which are attached by a pivot to the top of the inner arm to turn on, with screws to set them to the desired place; the semi-circle is designated by the letter D, in the drawings; this gauge moves horizontally on strap E, from the front backward, or vice versa, until it strikes the front of the arm hole, and locates the same, and is set by screws to the desired place; again, this gauge can be drawn perpendicularly, so as to increase the length of the shoulder, for a very full breasted man, or contracted so as to fit a hollow breasted man."

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15. For an *Improvement in Winding Watches;* Theodore Noel, Memphis, Tennessee, December 2.

Claim.—"What I claim as my invention is, the application to watches, of the machine keys, substantially as herein described and illustrated by the accompanying drawings, which keys and their boxes are enclosed by the watch case and form a part of the watch, rendering the use of the ordinary watch key unnecessary, without the expense and great friction of the complicated machinery heretofore used for the same object."

16. For an *Improvement in Carriage Perch;* Lewis E. Stilwell, Franklinville, New York, December 2.

Claim.—"What I claim as my invention is, constructing the front extremity of the perch so as to form a spindle, which passes through a tube on the turning plate, to connect it with the front axle-tree, and at the same time to form a hinge, on which the front axle-tree can rock, the latter being a new duty additional to that which the forward extremity of the perch has heretofore performed; thus increasing the efficiency, without increasing the complexity or cost of the coupling."

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17. For an *Improvement in Machines for Boring Holes in Posts;* Thomas T. Strode, Coatesville, Pennsylvania, December 2.

Claim.—"Having thus described my improvements on the machine for boring holes in posts for fencing, what I claim therein as new is, combining the pivoted bar R, provided with a catch and inclined plate S T, and long arm V, and stop or pin *p*, with the gauge bar U, provided with rows of pins *g*, and mounted in bearings in the inclined carriage G, whereby the movement of the latter is regulated in moving the timber laterally in boring a series of holes as described in the specification.

"I also claim the combination of the pivoted beam P, inclined plane *b*, inverse half nut screw *f*, and propelling screw shaft M, whereby the carriages are made to advance toward the boring tool, and is disengaged, for the purpose and in the manner described and represented.

"I do not, however, intend to confine my claim to the precise construction described in the foregoing specification, but to use such a form of construction as may be the best adapted to accomplish the desired object by means substantially the same. Neither do I claim any portion of the machine above described, that has been practised successfully by others, prior to its being invented by myself."

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18. For an *Improved Foundry Apparatus;* Chapman Warner, Louisville, Kentucky, patented in England, October 1849; December 2.

Claim.—"Having thus described my improvements in the art of founding, what I claim therein as new is, 1st. The method of making moulds for castings, by impressing the pattern into a measured quantity of sand contained in a flask, constructed with steps or protuberances and depressions. substantially as herein described, so that the mould, when finished, may be surrounded by sand varying in thickness, in proportion to the different degrees of compression which it receives by the impression of the pattern, in order that the density or hardness of the face of the mould may be rendered more uniform, substantially as herein set forth.

"2d, I claim the method of charging the half flask with the requisite quantity of sand, to form a half mould, by surmounting said flask with a hopper, and passing the two to and fro beneath a sand box, substantially as herein described.

"3d, I claim the method of detaching the hopper from the flask after the mould is formed, and of applying it thereto before the sand is introduced, substantially as herein described.

"4th, I claim the method of applying facing sand to the flask, prior to the formation of the mould, by means of apparatus, substantially as herein described.

"5th, I claim the method of tempering, distributing, and sifting moulding sand by means of machinery operating substantially as herein described.

"6th, I claim the core spindle, constructed substantially as herein described.

"7th, I claim the method of filling a series of flasks with melted metal by a single sprue by means of a sprue case, with which the flasks are connected, substantially as herein set forth.

"8th, I claim the combination of apparatus for tempering the moulding sand apparatus for distributing the tempered sand, and sifting it into the sand reservoir, and apparatus for supplying to the flask a measured quantity of sand from the reservoir, with a flask and pressing apparatus, whereby the sand is worked and the mould produced by machinery operating substantially as herein set forth."

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19. For an *Improvement in Running Gear of Locomotives;* Ross Winans, Baltimore, Maryland, December 2.

Claim.—"What I claim as my invention is, the use of steel springs for the support of

the weight carried by the driving wheels of a locomotive engine, in combination with bearing or supporting wheels, placed both before and behind the aforesaid driving wheels, which bearing wheels support a portion of the weight of the engine, through the medium of steel, air, india rubber, or other springs, possessing the properties herein described as belonging to steel springs as distinguished from steam springs, for the purpose set forth in the specification.

"I also claim the employment of steam springs or steam pressure operating separately from the propelling cylinders, for the purpose of varying the pressure of the driving wheels of a locomotive engine upon the rail of the road, in combination with bearing or supporting wheels placed both before and behind the aforesaid driving wheels, which bearing wheels support a portion of the weight of the engine, through the medium of steel, air, india rubber, or other springs, possessing the properties herein described, belonging to steel springs, as distinguished from steam springs, for the purpose set forth in the specification."

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20. For an *Improvement in Apparatus for Opening and Closing Gates;* Enoch Woolman, Damascoville, Ohio, December 2.

Claim.—"Having thus described my improved gate, what I claim therein as my invention is, making a blank space on the lever *o*, and vibrating it so far as to disengage the cogs upon it from the cogs upon the plate *l*, so that the gate may be opened and closed by persons on foot without the aid and without operating the lever *o*, in combination with the connecting of the bar *d*, or latch, to the lever *o*, by the rope *g*, so as to unlatch the gate, when the lever *o*, vibrates before the cogs on the lever *o*, gear into the cogs upon the plate *l*, to open the gate, substantially as described."

MECHANICS, PHYSICS, AND CHEMISTRY.

Experiments on the Conducting Powers of Wires for Voltaic Electricity. *By* C. L. Dresser, *Esq.**

The instrument used in these experiments was the glass thread galvanometer of Ritchie, described in the Philosophical Transactions.† This instrument, though one of the most perfect kind, easy of construction, well adapted for the measurement of electro-magnetic forces, and extremely accurate, has not received that attention from scientific men to which the facility of its use entitles it. Requiring no calculation, a vast number of experiments may be read off in rapid succession.

A few alterations were made in its construction.

1. The graduated card placed under the needles was discarded as being no measure of the forces exerted, and a plain card with a black mark under the centre of influence of the conducting wires substituted. To this mark the needles were carefully adjusted at every experiment.

2. The graduated card at the top was enlarged to five inches diameter, and carefully graduated to degrees; and by an index traversing this card, the degrees of torsion necessary to bring the deflected needle vertical to the black mark on the lower card was read off easily to a fraction of a degree.

3. The graduated plate turned on its own axis, independently of the axis of the glass thread, rendering the adjustment of the needles easy and perfect.

4. The needles were considerably increased in size, and highly magnetized.

With these alterations, the action of the galvanometer was certain

* From the London, Edinburgh, and Dublin Philos. Magazine, September, 1851.

† Philosophical Transactions, 1850, p. 218.

and delicate, returning after even a deflexion of a thousand degrees, or three times round the card, with certainty to the index mark on the lower card; and the same experiment repeated corresponding to the fraction of a degree.

The battery used was my gas-carbon battery, and the following means were adopted to keep it constant:

1. The nitric acid cell was filled with the acid of commerce, but the zinc cell only half filled with dilute sulphuric acid.

2. The prism of carbon was suspended at its top to a rack-work, by which its immersion to a greater or less depth was regulated; consequently, any required amount of electricity obtained.

With these precautions, a constant current of electricity was maintained for hours; rarely varying, after effecting a torsion of three or four hundred degrees, one degree for hours. By this means also, at all times the same amount of current could be obtained, rendering it easy to recommence the experiments.

TABLE I.—*Battery power* 400. *Each wire was No.* 20.

Feet.	Copper wire.	Differences.	Feet.	Iron wire.	Differences.
1	398		1	330	
2	380	18	2	280	50
3	365	15	3	240	40
4	352	13	4	210	30
5	310	12	5	190	20
6	330	10	6	172	18
7	320	10	7	158	14
9	296	24	9	135	22
10	286	10	10	128	7
12	269	17	12	112	12
14	251	15	14	100	12
16	240	14	16	92	8
18	230	10	18	85	7
20	220	10	20	78	7
			22	73	5
			24	68	5
			26	64	4
			28	60	4

From the above table of experiments, it is evident that the often quoted law of the conducting power of wire being inversely as the length does not obtain in short lengths. But there is an evident intimation of some other law, and probably different for different metals.

Broke glass thread. New thread gives 300, without altering battery power.

TABLE II.—*One cell. No.* 16 *wire.*

Feet.	Copper.	Differences.	Iron.	Differences.
1	282		256	
2	275	7	235	21
3	268	7	217	18
4	262	6	200	17
5	256	6	187	13
6	148	5	175	12
7	138	5	164	9
8	133	5	157	7

From this table, compared with Table I., it does not appear that with a thicker wire there is any nearer approach to the old law, but also that some other law obtains.

TABLE III.—*No.* 16 *Wire. Battery power* 400. *Intensity two cells.*

Feet.	Copper.	Differences.	Iron.	Differences.
1	400		355	
2	391	9	320	33
3	382	9	294	26
4	476	6	270	24
5	370	6	252	18

Increase of intensity does not appear to approach near to the supposed law.

TABLE IV.—*Wire measured with a micrometer in hundredths of an inch. Battery power* 207. *One foot of wire. Diameter of galvanometer wire* ·740 *of an inch.*

Measure.	Copper: Current conducted,	Measure.	Iron: Current conducted.
370	190	360	129
480	195	510	65
700	206½	640	182
740	207	720	188

The wires of iron and copper on parallel lines were said to be of the same gauge, but the micrometer showed them to be of very different diameters. This table does not coincide with the law of the conduction of wires of different diameters being as the squares of their diameters.

Power of hydrogen to abstract the heat produced by the passage of electricity.

Battery power 410. Current through steel wire 175 hundredths of an inch.

Quantity conducted.

200 . . . . . wire red-hot in air.
310 . . . . . in hydrogen, and invisible in the dark.

In this experiment, battery power not observed.

Same wire as above.

In air red-hot 220
In current of air, quite cold 270

It would appear that the heating power of a current of electricity diminishes the power of conduction; also that hydrogen, by absorbing the heat, has the same effect as a current of cold air.

TABLE V.—*No.* 20 *wire placed in the air-bulb of sulphuric acid thermometer.*

Battery power.	Differences.	Current conducted.	Differences.	Degrees of heat.	Differences.
67		58		26	
92	25	73	15	44	18
107	15	84	11	75	31
124	17	91	7	90	15
145	21	100	9	124	34
170	25	102	2	143	19
202	32	108	6	160	17

These experiments, very tedious and difficult to conduct, do not appear to indicate any particular law.

Much in this department of electricity appears yet to be done, before we are able to define the laws of conduction, and there are many difficulties to be encountered. It is almost impossible to get wire of any length, of equal thickness and texture. It is also not easy always to obtain the same connexions, and the least variation in this respect vitiates the experiments. Some of the anomalies in the tables are to be traced to these causes.

A difference of temperature also, it appears, will affect conduction. Even bending the wire with so delicate an instrument as the torsion galvanometer, will affect the experiment; and twisting will alter its powers permanently.

On a New Blowing Engine, working at High Velocities. By Mr. Archibald Slate.*

At a former meeting, the writer laid before the Institution the opinions which he entertained on the subject of blowing cylinders, proposed to be driven at high velocities, concluding that there would result thereby a large economy in the manufacture of iron throughout the entire plant and appliances of this indispensable machine. (See *Artizan*, 1850, p. 203.)

It was observed in the former paper that, since the application of the double-acting movement, introduced some fifteen years ago, the blowing cylinder has remained, up to the present time, without a single other essential improvement. As left at that period, it continues a large and cumbrous machine, with complicated and slow motion; insomuch that the light and elastic body of the atmosphere is driven through at no higher velocity than the more ponderous body, water, can be passed through an ordinary pump. While the motive power was derived, in most instances, from a waterfall, there might indeed be alleged some semblance of a reason for the slow motion that has been spoken of; although, even in such circumstances, it is but little conceivable how the intervention of machinery, to quicken the passage of the lighter and elastic medium, should so long have remained a desideratum. But the question becomes infinitely more inexplicable, since the motive power employed has in almost every instance been steam, itself a medium in the highest degree light and elastic; capable, at the same time, of being worked under a pressure, and at a velocity, far beyond anything required at present, or that probably ever will be required of the air from a blowing cylinder.

Such being the facts, and contemplating the power and speed attained on the railway by locomotive engines, the writer was led to reflect that a similar power was at least capable of being applied to the blowing cylinder; and, while impressed with this train of thought, he had occasion, in the latter part of the year 1848, to make use of some small 9-inch cylinders, driven by air from a large blowing engine. It was then remarked, that these small engines, when driving shafts only, sometimes attained a velocity of 200 revolutions per minute, under the ordinary

* From the London Artizan for October, 1851.

blast pressure; when the idea suggested itself, that it might be possible to reverse their motions, making them blowing cylinders in place of air engines; and this idea, on being tested, turned out to be correct.

The cylinder experimented on was of nine inches diameter, and one foot stroke, and being driven at the rate of 320 revolutions per minute, discharged the air at $3\frac{1}{2}$ lbs. per square inch, through a tuyere of $1\frac{1}{8}$th inch, being exactly $\frac{1}{64}$th part of the area of the blowing piston. This performance exceeds, as is well known, by double its amount, that of any ordinary engine; the total area of the tuyeres, with a 90-inch blowing cylinder, at a pressure of $3\frac{1}{2}$ lbs., being about fifty circular inches, which is only $\frac{1}{144}$ part of the area of the blowing cylinder.

Assured by the complete success of this experiment, the writer proposed to construct a steam and a blowing cylinder of two feet stroke; the cylinder for steam to be of ten inches diameter, and that for blast of thirty inches; and to couple them, if necessary, with a second and similar set, acting at right angles upon a common axle; and he is still of opinion that such would probably prove the best arrangement, as well as the best proportions to observe in construction.

But in the actual experiment, the cylinders proposed to be placed at right angles have not yet been constructed. The size of that used, owing to peculiar circumstances, has been considerably enlarged. In 1850, finding that more air was required for the manufacturing purposes to which it was applied, the writer, and Mr. Cochrane, his partner, resolved to make a blowing cylinder of such a size as would practically test the question of high velocities; and a steam engine, having a cylinder of fourteen inches diameter, being ready at hand, was fitted with a 40-inch blowing cylinder, and to this engine the further remarks have reference. The stroke is two feet; the total weight of the engine about six tons; the boiler made use of weighed three tons, thirteen cwt.; its length over all is twenty-seven feet, having egg ends; its diameter four feet.

The first set of experiments were made in presence of Mr. Beyer, Mr. M'Connell, Mr. Daniel Gooch, Mr. Geach, Mr. Evers, Mr. Cochrane, and several other gentlemen who took an interest in the proceedings, which were of the following nature.

On the outlet pipe were placed four tuyeres: two of them $2\frac{1}{4}$ inches diameter, and the remaining two 2 inches diameter, all blowing into the open air. The engine being run up to its full velocity, reached 145 strokes per minute. At this rate, the density of the air issuing from the four tuyeres approached nearly to five lbs. per inch, the engine remaining perfectly noiseless and steady, and the blast being so continuous and regular, that the mercury in the barometer did not vary more than one-eighth of an inch—in fact, continued barely living in the tube.

A variety of minor experiments followed, not necessary to be dwelt upon at present; but it is believed perfectly warrantable to state, as the result, that each person present felt convinced that he had seen exhibited a blowing machine of at once a powerful, cheap, and efficacious character.

Although the experiments thus detailed were of the most satisfactory description, and indeed had exceeded every expectation of a first performance, the writer nevertheless felt convinced, from observation of the working, that the steam might be considerably economized; and before

proceeding to apply it to actual use, resolved to fit the engine with an adjusting expansive valve, by which such economy might be realized. When this had been fitted, and the requisite attachments made, its full complement of blast was thrown into one furnace, viz.: 3500 cubic feet of air per minute; the pressure of the air in the main, close upon the engine, was a little in excess of three lbs. to the inch; at the tuyeres on the furnace, it was, if anything, rather under three lbs.: but this slight discrepancy probably took its origin from the tortuous character and length of the main, which exceed 300 feet; a circumstance which it was found impossible to avoid, without leaving out of consideration the objects to which the new blowing power is ultimately to be applied.

The engine, during the trial, varied from 96 to 100 strokes per minute. The steam from the one small boiler, 27 feet by 4, remained full and sufficient for this work, after the engine had worked every day for nearly a month, and had been seen by Mr. Benjamin Gibbons, and several other persons connected with the iron trade. An opportunity again occurred of trying it upon one furnace, with the same result as above; this last experiment was made in the presence of Mr. Samuel Blackwell. With regard to fuel, on a subsequent trial, while working in connexion with a larger blowing engine of the ordinary sort, delivering into the mains 3000 cubic feet of air, at a density of $3\frac{1}{4}$ lbs. to the inch, it was found to amount, by measurement, to two tons five cwt. of small refuse coal or slack, in twelve hours.

Although the writer does not present the arrangement of the engine, here given, as a perfect machine, he can entertain no doubt that the development of the principle must greatly stimulate the production of iron. It will be perceived how, by the use of blowing machines, working at high velocities, the expense of plant and machinery for blowing a furnace may be reduced, at the rate of sixty-five per cent., from what it stands at present; or, to one-third of the present amount. The above-mentioned experiments at Woodside have proved such engines to be adequate to as large a class of works as exist in Staffordshire. Their simplicity and portable character make them equally available at the smallest charcoal furnaces, in however remote a quarter there might be occasion for their use.

Mr. Middleton inquired, whether the blast from the small engine went direct to the furnace, or through a reservoir?

Mr. Slate said, they had a receiver, twelve by four feet; but in the experiment with one furnace, when the other was in repair, they let it blow through the whole of the large air main.

Mr. Middleton said, that he remembered the late Mr. Murdock worked a similar blowing engine at Soho, twenty-five years ago; it was direct-acting, and the only difference was that it had a D valve, and worked at a slower velocity than Mr. Slate's engine.

The Chairman said, he had a similar blowing engine in regular work at Wolverton, only working vertically instead of horizontally; but his engine only made from fifty to sixty strokes per minute, while that now under description performed one hundred and thirty in the same time. This gave the blowing engine of Mr. Slate a great advantage, and was its distinctive feature; the great gain was in the high speed employed.

Mr. Davies observed, that Mr. Slate's engine could give a steady blast for a furnace, with full pressure, which Mr. Murdock's engine could not do.

Mr. Slate remarked, that though Mr. Murdock's engine had been at work at Soho for the period stated, no further progress had been made in the construction of the blast engine; for at Soho they still continued to make only the old ponderous engines.

Mr. Middleton said, it had been applied at the smithy at Woolwich, and had been at work there for many years. He thought, though Mr. Slate's engine was different in some respects, it was similar in principle to Mr. Murdock's.

Mr. W. Smith was quite satisfied that Mr. Slate's engine would maintain a constant blast for a furnace. He had seen Mr. Murdock's engine at work; it was an open-top cylinder, and was quite another kind of engine. He thought that Mr. Slate's plan of blowing engines was an important advantage in the saving of expense in the erection of iron works, and he believed that a blowing engine could now be erected for £500 on that plan, as well as one on the old plan for £1500, to do the same work.

The Chairman thought that Mr. Slate's engine was certainly deserving of approbation, and he hoped that he would continue his investigation of the subject, as any improvement or economy in the manufacture of iron was of great importance.

On the Use of Electro-magnets made of Iron Wire for the Electro-magnetic Engine. By J. P. Joule, Esq. *Communicated in a Letter to the late* Mr. Sturgeon.*

Dear Sir: In my last letter I gave you an account of some experiments which were intended to prove that electro-magnets made of iron wire are the most suitable for the electro-magnetic engine. In those experiments round wire was used; and it was my opinion that the wire magnets were put in a disadvantageous position, in consequence of the interstices between the wires. I have since confirmed my views on this subject by the following experiment:—

I constructed two magnets. The first consisted of sixteen pieces of square iron wire, each $\frac{1}{11}$th of an inch square and 7 inches long, bound very tightly together so as to form a solid mass, whose transverse section was $\frac{4}{11}$ths of an inch square; it was enveloped by a ribbon of cotton, and wound with sixteen feet of covered copper wire, of $\frac{1}{16}$th inch diameter. The second was made of solid iron, but was in every other respect precisely like the first. These magnets were fitted to the apparatus used in my former experiments, and care was taken to make the friction of the pivots equal in each. The mean of several experiments gave 162 revolutions per minute with the first, and 130 with the second magnet.

In the further prosecution of my inquiries, I took six pieces of round iron of different diameters and lengths, and also a piece of hollow round iron, half an inch in diameter, and $\frac{1}{13}$th of an inch thick in metal; these were bent into the U-form, so that the shortest distance between the poles of

* Annals of Electricity, vol. iv. p. 58.

each was half an inch; each was then wound (with the usual precautions to ensure insulation) with ten feet of covered copper wire of $\frac{1}{40}$th inch diameter. The lengths and diameters are given in the following table. No. 1 is the hollow magnet. The attraction was ascertained by suspending a straight steel magnet, $1\frac{1}{2}$ inch in length, horizontally to the beam of a balance, and bringing the several electro-magnets directly underneath at the distance of half an inch, which was preserved by the interposition of a piece of wood half an inch thick. Care was taken that the battery remained constant during the experiments.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
Length in inches,	6	$5\frac{1}{2}$	$2\frac{2}{3}$	$5\frac{1}{4}$	$2\frac{1}{2}$	$5\frac{1}{4}$	$2\frac{1}{2}$
Diameter in inches,	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{1}{4}$
Weight lifted in ounces,	36	52	92	36	52	20	28
Attraction for steel magnet in grains,	7·5	6·3	5·1	5·0	4·1	4·8	3·6

A steel magnet of such dimensions as enabled me to compare it fairly with the electro-magnets, was found to exert an attraction of 23 grains for the small steel magnet, though its lifting power was only 60 oz.

These results will not appear surprising if we consider, first, the resistance which iron presents to the induction of magnetism; and secondly, how very much the power of iron to conduct magnetism is exalted merely by the completion of the ferruginous circuit. In order, however, to explain why the long electro-magnets have a *greater* attracting power at a distance, though they lift *less* weight, than the short magnets of the same diameter, it will be necessary to observe that it was impossible to wrap the whole ten feet of wire on the smaller magnets, without disposing it in two or three layers (according to the size of the magnets.) This was a great disadvantage; and one might have anticipated in consequence, that the power of the long magnets would be greater than that of the short ones for lifting, as well as distant attraction, which is contrary to the results of the table; this may however be explained, if we admit that the comparative resistance of the iron of the electro-magnet increases to a very great amount, when its magnetism is so greatly excited as by the contact of the armature.

Nothing can be more striking than the difference between the ratios of lifting to distant attractive power, in the different magnets; whilst the steel magnet attracts with a force of 23 grains and lifts 60 oz., No. 3 attracts 5·1-grains and lifts 92 oz.

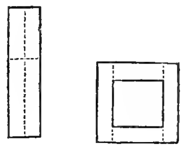
The following are some general directions for making electro-magnets for lifting:—1st, The magnet, if of considerable bulk, should be compound, and the iron used of good quality and well annealed. 2d, The bulk of the iron should bear a much greater ratio to its length than is generally the case. 3d, The poles should be ground quite true, and fit flatly and accurately to the armature. And 4th, The armature should be equal in thickness to the iron of the magnet.

I shall now proceed to consider with greater care what form of electro-magnet is best for distant attraction, as that is the only force of any use in the electro-magnetic engine. Here two things must be considered; the length of the iron, and its sectional area.

Now with regard to the length of the iron, I have found that its in-

crease is always accompanied with disadvantage, unless the wire is (by using a shorter length) forced to too great a distance from the iron. In making magnets for an engine, it will be proper to use a length less than that which gives the maximum of attraction, on several accounts.

The next thing to be considered is the sectional area. You have shown* that, on placing a hollow and solid cylinder of iron successively within the same electro-magnetic coil, the hollow piece exerted the greatest influence on the needle. I wished to ascertain whether a hollow magnet could be represented by a solid one, of which the sectional area and circumference are the same, and the thickness of which is twice that of the hollow magnet. The accompanying figures represent sections of hollow and solid rectangular magnets; and it will be seen, that if either of them is divided at the dotted lines, the separate pieces, when put properly together, will make up the other. Two electro-magnets were constructed, each 7 inches long, and wound with twenty-two feet of insulated copper wire; the sections were similar to, but twice the size of the figures. Their attractions at half an inch distance for the contrary pole of a straight steel magnet were as follows:—



	Hollow magnet.	Solid magnet.
Attraction in grains, . .	1·9	1·7
Do. with a more powerful battery, .	4·5	4·0

The above results show that the hollow magnet has the greater attractive force; but I do not think that the difference between the two is so great as to counterbalance the practical advantages which solid bars would give if used in the engine. I shall now therefore attempt to determine the sectional area of solid iron most proper for various galvanic powers.

I made five straight electro-magnets of square iron wire $\frac{1}{11}$th of an inch thick; each was 7 inches long, and wound with twenty-two feet of insulated copper wire of $\frac{1}{16}$th of an inch diameter. No. 1 consisted of nine, No. 2 of sixteen, No. 3 of twenty-five, No. 4 of thirty-six, and No. 5 of forty-nine square iron wires, arranged in the form of square prisms. Five other electro-magnets were made of square iron rod, but in every other respect were exactly similar to the first. The following are the attractions (at half an inch distance) for a straight steel magnet, with three different voltaic forces:

		No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
1st experiment.	Attraction of iron bar magnet in grains,	1.5	1·9	1·6	2·1	2·0
	Ditto of wire magnet,	2·1	2·1	1·7	2·0	1·9
2d experiment.	Iron bar magnet,	2·0	2·5	2·35	2·45	2·2
	Wire magnet,	2·6	2·8	2·1	2·2	2·05
3d experiment.	Iron bar magnet,	2·7	3·6	3·4	3·2	3·1
	Wire magnet,	3·3	3·8	3·0	2·9	2·65

The square iron wire of which the wire magnets were constructed, was taken at the same degree of temper that it possessed when it came

* Annals of Electricity, vol. i, p. 470.

from the manufacturer. It was in consequence not so well annealed as the iron bars. On this account the numbers opposite the wire magnets are less than they would have been with better annealed wire: still the results of the table seem anomalous; for it will be remarked, that whilst the wire magnets are the most powerful of the smaller electro-magnets, the bar magnets are most powerful of the larger ones.

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Action of the Sea-Worm on Timber, and the Best Means of Protection. By SAMUEL CLEGG, JUN.*

Timber exposed in marine works is subject to be destroyed by the *teredo navalis*, and *limnoria terebrans.* The *teredo*, by means of auger-like shells with which its head is furnished, bores into the timber, and forms long circular holes, lining them with a shelly substance. These worms are very numerous, and the timber attacked by them soon assumes the form of a honeycomb. They appear to penetrate all kinds of timber; that which it seems to destroy with the greatest ease is fir, in which it works more speedily and successfully than in any other, and perhaps grows to the greatest size. In a fir-pile taken from the old pier-head at Southend, a worm was found 2 feet long and $\frac{3}{4}$-inch in diameter, and they have been heard of 3 feet and 4 feet in length, and 1 inch in diameter. In hard wood they do not grow so large. Wood which has been perforated presents to casual observation no symptom of destruction on the surface, nor are the animals themselves visible until the outer part of the wood has been broken away, when their shelly habitations come in sight, and show the perfect honeycomb they have formed. On a close examination of the wood, however, a multitude of very minute perforations are discovered in the surface, generally covered with a slimy matter; and on opening the wood at one of these, and tracing it, the tail of the animal is immediately found, and after various windings and turnings the head is discovered, which in some cases is as much as 3 feet from the point of entrance. Sometimes it will happen, especially if the wood has been much eaten, that their shelly tubes are partly visible on the surface, but this is rare. They enter at the surface, and bore in every direction, both with and against the grain of the wood, growing in size as they proceed.

The *limnoria terebrans* is a minute crustacean, similar in appearance to a woodlouse, and confines its destructive operations to the surface of the wood, so that what is left undestroyed by the teredo is completed by the limnoria. On the surface of a piece of wood, only 12 inches square, Mr. Paton estimated no less than 54,000 different perforations, caused by this little creature penetrating to about an inch from the surface.†

The teredo enters the timber at various heights of the tide, sometimes confining their operations between low water mark of neap tides and the bottom of the river, occasionally piercing below the ground; and at others, attacking the wood 8 or 10 feet above low water, to 2 feet below the bed of the sea. They, however, appear gradually to relax in their destructive

* From the London Architect for October, 1851.

† They are said not to attack teak, but this is doubtful.

habits from low water towards high water. The limnoria attacks the timber higher up than the teredo, and have been found at 2 feet below high water mark.

At Southampton, piles 14 inches square have been eaten down to 4 inches in four years. At Southend old pier, the teredo showed itself in six months after the completion of the work; and in four years many of the piles, from 12 to 14 inches square, were eaten through. A pair of dock gates at Hartlepool were destroyed in eight years. At Sheerness, after a time, it was no uncommon thing to see several piles, apparently sound, floated away at each tide; indeed, they were so thoroughly perforated by the teredo, that in still weather, by putting the ear to the side of the pile, the worms could be heard at their boring labors.

Cold-blooded animals are not affected by poisons; for instance, a frog cannot be killed with prussic acid. The teredo is an animal of a much lower order than the frog, therefore it might be inferred that the impregnation of timber with creosote, or other poisonous matter, will not protect it from their ravages; but, from observation, it appears that creosote does protect the wood, to some extent at all events. A piece of unprepared timber, 800 feet from the beach at Lowestoft, was taken from a guide pile which had been left after the work was completed; it was sawn off below low water mark of neap tides, and it was evident that whilst the limnoria was attacking the surface, the teredo was destroying the interior; at the same depth, and close adjoining to the guide pile, a piece of creosoted permanent pile was sawn off, which was perfectly sound.

A most searching examination, occupying many days, was made upon every pile in Lowestoft harbor, by the direction of Mr. Bidder. There was no instance of an uncreosoted pile being sound—they were all attacked, both by the limnoria and the teredo to a very great extent, and the piles in some instances were eaten through. All the creosoted piles were quite sound, being neither touched by the teredo or the limnoria, though covered with vegetation, which generally attracts the teredo. Some creosoted timber put into Teignmouth harbor by Mr. Brunel, was found untouched by the worm after seven years; whereas all the unprepared timber was more or less affected. It may be, that the creosote being nauseous prevents the worm from attacking the timber. The cost of creosoting railway sleepers is about $4\frac{1}{4}d.$ per cubic foot; that of preparing timber to resist the ravages of the worm is nearly $6d.$ per cubic foot.

The mechanical means adopted for the protection of timber from the sea-worm, are sheathing with copper, studding with iron scupper nails, and casing with cast iron.

Copper sheathing was used at Southend, but the limnoria not only penetrated between the copper and the timber, but the copper itself rapidly decayed; therefore this is not a method to be imitated.

Wrought iron nails, with heads about one inch square, driven into the piles close together, is an effectual preservative; the iron corrodes, and forms a solid impenetrable rust entirely over the timber. The cost is about $11d.$ per superficial foot. Casings of cast iron are not more effectual, and are much more costly.

A plan stated to be effectual at the Herne Bay pier, may be employed in countries where the above modes cannot be followed. A wooden

casing was formed round each pile, leaving a space of about an inch all round, which was rammed full of lime or cement concrete; the worms commenced their ravages, but appeared to have been checked, and not to have been able to exist when so enclosed.

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*The Philadelphia and Liverpool Screw Propeller Steam Navigation Company's New Iron Vessel, "City of Manchester."**

Built and fitted by Messrs. Tod and McGregor, engineers and iron ship-builders, Glasgow, 1851.

	British.		American.	
Builder's Measurement.	Tons.		Tons.	
Hull	$1776\frac{79}{94}$		$1756\frac{13}{95}$	
Contents of engine-space	$568\frac{93}{94}$		$563\frac{0}{95}$	
Ditto of shaft tunnel	$10\frac{58}{94}$		$10\frac{48}{95}$	
Register	$1197\frac{2}{94}$		$1184\frac{57}{95}$	
			British Act for Foreign Vessels.	
New Measurement.	Ft.	Ins.	Ft.	Ins.
Length on deck	261	8	261	8
Breadth on ditto, amidships	36	2	36	2
Depth of hold, ditto	25	3	25	3
Length of engine-room	77	7	77	7
Ditto of shaft-tunnel	79	7	79	7
Breadth of ditto	5	0	5	0
Depth of ditto	6	9	6	9
Tonnage.	Tons.		Tons.	
Hull	2109·81		1844·83	
Contents of engine-room	770·15		770·01	
Ditto of shaft-tunnel	29·75		29·75	
Register	1309·91		1044·78	

A pair of engines (beams at top) of 366 horses nominal power; diameter of cylinder 71 inches × 5 feet length of stroke; two-bladed screw, diameter 14 feet; pitch 18 feet; driving wheel, diameter 9 feet 10 inches; 93 cogs; pinion diameter 4 feet 5 inches, 42 teeth; pitch 4 inches; 4 sets of cogs, 9 inches in breadth and $1\frac{1}{2}$ inches between them; 3 tubular boilers; 9 furnaces, and 448 tubes in all; chimney 6 feet × 30 feet; 2 iron masts, fore ditto 81 feet, and second 83 feet long, and both are 2 feet $2\frac{1}{2}$ inches in diameter; frames of hull, $5 \times 3 \times \frac{5}{8}$ inches, and 18 inches apart; propeller frame $7\frac{1}{4}$ inches square; keel $9 \times 3\frac{1}{2}$ inches; plates $\frac{7}{8}$ to $\frac{3}{8}$ of an inch in thickness. Has accommodations for 180 passengers; and is manned by a crew of 86 men, 14 of which are in the engine-room. Sailed from Greenock for Belfast on the 16th of July last; arrived there in 8 hours and 10 minutes; at the rate of 13 miles per hour; sailed from

* From the London Artizan, for October, 1851.

Belfast for Liverpool (156 miles), arrived at the latter in 12 hours and 55 minutes; draft of water, forward, 12 feet, and 14 feet 6 inches aft; steam pressure 10 lbs. per square inch; the engines making an average of 25 revolutions per minute.

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*The Glasgow and New York Screw Steam Navigation Company's Iron Vessel "Glasgow."**

Built and fitted by Messrs. Tod and McGregor, engineers and iron ship-builders, Glasgow, 1851.

Dimensions,		Ft.	Ins.
Length on deck		250	0
Breadth on ditto, amidships		35	2
Depth of hold, ditto		26	2
Length of tunnel for screw-shaft		74	0
Breadth of ditto		5	0
Depth of ditto		7	2
Length of engine-space		78	2
Tonnage.		Tons.	
Hull		1,961·78	
Contents of tunnel for screw-shaft,	28·83		
Ditto of engine-space	780·51		
		783·34	
Register		1,152·53	

A pair of engines (beams at top) of 366 horses nominal power; diameter of cylinders 71 inches × 5 feet; diameter of driving-wheel 9 feet 10 inches, having 93 cogs; diameter of pinion 4 feet 5 inches, having 42 teeth; pitch 4 inches; 4 sets of cogs; three-bladed screw, of cast-iron, 14 feet diameter; pitch 18 feet. Is fitted with Messrs. Lamb and Summers' patent sheet flue boilers, 3 in number; length 13 feet 2 inches; breadth 9 feet 3 inches; depth 15 feet 9 inches; 63 spaces, 21 in each boiler, and 7 opposite each furnace; length 7 feet; breadth $1\frac{3}{4}$ inch; depth 3 feet 6 inches; 9 furnaces, 3 in each boiler; length 7 feet 3 inches; breadth 2 feet 4 inches; depth 4 feet; chimney 6 feet × 30 feet; frames of hull $5 \times 3 \times \frac{5}{8}$ inches, and 18 inches apart; keel $8\frac{3}{4} \times 3\frac{1}{2}$ inches; propeller-frame $7\frac{1}{2}$ inches square; 2 iron masts; the foremast is 81 feet long, and the second is 83 feet long, and 2 feet $2\frac{1}{2}$ inches diameter: they are painted in imitation of wood. She will carry a cargo of 1763·36 tons, (which includes 600 tons of coals, stores, &c.,) and has accommodations for 170 passengers.

She was launched from the building-yard, Meadowside, on Saturday, the 16th of August, the draft of water being, forward 6 feet 9 inches, aft 7 feet 7 inches. On the trial trip, September 5th, she sailed out as far as Pladda, and went from the clock to the Cumbrae light-houses (a distance of 15·6 miles) in 74 minutes, or at the rate of $12\frac{1}{2}$ miles per hour, having a plentiful supply of steam, the screw making about 60 revolutions per minute. The *Glasgow* sailed from the Clyde to New York on

* From the London Artizan, November, 1851.

the 16th of September, on the first voyage outward, being only one month from the launch to day of sailing.

For the Journal of the Franklin Institute.

Notes on the U. S. Steamer "Iris." By Chief Engineer, B. F. Isherwood, *United States Navy.*

The U. S. Steamer "Iris" was originally a vessel bought into the Navy from the merchant service in 1847. She made but one short cruise to the Gulf of Mexico, when, proving entirely unadapted for naval purposes, she was sold out of the service, and under the name of the "Osprey," now plies between Philadelphia and Charleston.

Hull.—Length on deck, 145 feet; breadth of beam, 27 feet; depth of hold, 11 feet; burthen, 388 tons; immersed amidship area of hull, 229 square feet; mean draft of water, 9 feet 9 inches.

Engine.—One piston rod, condensing steeple engine; diameter of cylinder, 54 inches; stroke of piston, 6 feet; space displacement of piston per stroke, 95·424 cubic feet.

Paddle Wheel.—Of the common radial kind; diameter 23 feet; number of paddles in wheel, 20; length of paddle, 6 feet; breadth of paddle, 2 feet 4 inches; area of one paddle, 14· square feet; mean immersion of lower edge of paddle, $3\frac{1}{4}$ feet; $4\frac{1}{2}$ paddles in water with centre paddle vertical.

Performance.—The logs of the vessel give her performance for 445 hours steaming, using anthracite coal with a fan blast; and for 552 hours steaming, using bituminous coal with a natural draft.

The mean of her performance with anthracite coal was as follows: Speed of vessel, 6·586 knots of $6082\frac{2}{3}$ feet per hour; double strokes of piston per minute, 11·512; steam pressure in boiler above atmosphere, 21·8 pounds; anthracite coal consumed per hour, 946 pounds. Throttle one-fourth open; steam cut off at half stroke.

The mean of her performance with bituminous coal was as follows: Speed of vessel, 6·824 knots per hour; double strokes of piston per minute, 12·491; steam pressure in boiler above atmosphere, 12·5 pounds; bituminous coal consumed per hour, 1025 pounds; throttle wide open; steam cut off at half stroke.

The mean speed of vessel for the entire 997 hours, was 6·718 knots; double strokes of piston per minute, 12·054.

Owing to the *throttling off* when the anthracite was used, it is impossible to tell, in the absence of indicator diagrams, with any approach to reasonable accuracy, what was the initial steam pressure in the cylinder; the comparison of the relative economical evaporation of the two kinds of coal must be made from the weights of coal consumed per hour, and the cubes of the speeds of the vessel (supposing the resistances to the vessel to be the same,) as the measure of the effects. Because the powers will be as the steam used, (supposing the same back pressures in the cylinders in both cases,) the same degree of expansion for the steam being employed in both cases; and the powers are measured by the cubes of the speeds.

The consumption of coal in the two cases is 946 pounds and 1025 pounds per hour; the speeds 6·586 knots and 6·824 knots per hour; reducing these to proportionals, we have

Anthracite, 1·0000	Speed, $1{\cdot}0000^3 = 1{\cdot}0090$
Bituminous, 1·0835	" $1{\cdot}0361^3 = 1{\cdot}1122$

whence it appears that the economical evaporation of the bituminous is $\left(\frac{1{\cdot}1122}{1{\cdot}0835}\right)$ better than the anthracite's in the proportion of 1·0265 to 1·0000.

As, however, both the resistances to the vessel, owing to variations of draft and variable conditions of sea and weather, and the back pressure in the cylinder, constantly varied, though within such slight limits that the means on which the comparison is founded, probably present a correct relation; yet we are not entitled with so trifling a difference as the result shows, to conclude practically, other, that in the boilers of the Iris, both kinds of fuel produced equal effects. There is no reason for supposing that the losses of heat by *foaming* or *priming*, leakage of the cylinder valves and piston, and by *blowing off*, were not the same in both cases. The anthracite also furnished the steam for the small engine driving the fan blower, which effect is not included in the above calculation.

Power.—The actual power developed by the engine can be obtained with sufficient accuracy, from the data, when using bituminous coal. The throttle being wide, the initial cylinder pressure would be about 2 pounds less than the boiler pressure. The space comprised between the steam valve (which was also the cut off valve) and piston, including clearance, &c., is 2·464 cubic feet, or equivalent to a cylinder of 54 in. diameter, and 0·154 foot long. The steam was cut off at half stroke of piston; the boiler pressure was $12\frac{1}{2}$ pounds above the atmosphere, and allowing the initial cylinder pressure to be 2·2 pounds less than the boiler pressure; the total initial cylinder pressure would be 25 pounds per square inch; 3·154 of this steam would be expanded into 6·154, and give a mean pressure throughout the stroke of 21·31 pounds. The back pressure in the condenser was per gauge, 2·2 pounds, and allowing the back pressure in the cylinder to exceed it by 2.11 pounds, there would be a total of 4·31 pounds back pressure to be deducted, leaving the mean effective pressure throughout the stroke, (21·31—4·31,) 17 pounds per square inch.

$$\frac{2290{\cdot}22 \text{ ar. cyl. in sq. in.} \times 17 \times 12{\cdot}491 \text{ double st. pist. per. min.} \times 12 \text{ ft. length double stroke.}}{33000}$$

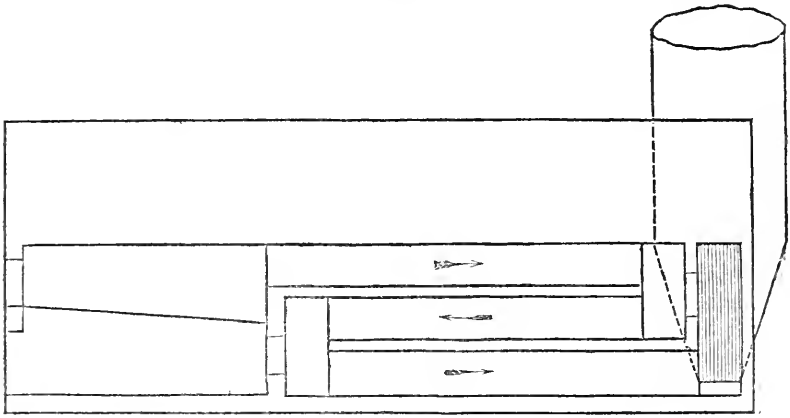
$= 176{\cdot}844$ horses power.

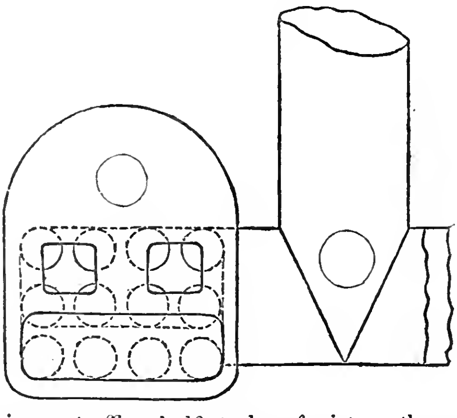
Boilers.—The boilers were of iron, and two in number, of the double return drop flue kind, as shown in the annexed sketch.

Length of each boiler, ...	23 feet.
Breadth of "	6 feet 10 inches.
Height of "	8 " 3 "
Cubic contents of circumscribing parallelopipedon of each boiler,	$1296\frac{5}{8}$ cubic feet.
Area of heating surface in the two boilers, ...	1420 square feet.
" grate " " " . .	80 "
Cross area of each of the three rows of flues ($14\frac{1}{2}$ in. diam.) in the two boilers, ...	9·17 "
Cross area of smoke chimney, ...	11·54 "
Height of smoke chimney above grate, ...	40 feet.

PROPORTIONS.

Proportion of heating to grate surface, ...	17·75 to 1·000
" grate surface to cross area of each of the three rows of flues in the two boilers,	8·724 to 1·000
" " smoke chimney, . .	6·932 "
" heating " each of the three rows of flues in the two boilers,	154·853 "
" " smoke chimney, .	123·050 "
" " cubic foot of space displacement of pist.	14·881 "
per double-stroke of piston per minute,	1·191 "
" grate " " .	0·067 "
" " " space displacement of pist.	0·838 "
Consumption of bituminous coal with natural draft per square foot of grate surface per hour,	12·812 pounds.
" anthracite " fan blast . .	11·825 "
" bituminous " natural draft heating	0·722 "
" anthracite " fan blast . . .	0·666 "
Sea water evaporated by one pound of bituminous coal per hour,	5·118 "
Sea water evaporated by one square foot of heating surface per hour, burning bituminous coal, . . .	3·624 "





The steam being cut off at half stroke of piston, there would be filled per stroke $\left(\frac{95\cdot424}{2}\right)$ 47·712 cubic feet, to which must be added 2·464

cubic feet comprised between the cut off valve and piston, making 50·176 cubic feet, which, multiplied by the number of strokes per minute, viz: 24·982, and then by 60, gives 75209·81 cubic feet of steam of 25 pounds per square inch total pressure per hour. The relative volumes of steam of this density and water, is as 1044 to 1, and $75209{\cdot}81 \div 1044 = 72{\cdot}04$, which, multiplied by 64·3 pounds, the weight of a cubic foot of sea-water, gives 4632·172 pounds of sea-water evaporated per hour by 1025 pounds of bituminous coal, or 4·519 pounds of water per pound of coal. To this must be added the loss by blowing off, obtained as follows:

The density of the water in the boiler being carried at $\frac{2}{32}$ of *Sewell's Salinometer*, one-half of the whole quantity pumped into the boiler would be blown out, leaving the other half to be evaporated. The water was furnished to the boiler from the reservoir, at a temperature of 100° F.; the temperature of the steam, and consequently of the water in the boiler, corresponding to a total pressure of 27·2 pounds, was 246° F.—the loss of heat in the blown out water was therefore 146° F. The total heat of steam being taken at 1202° F., and the temperature of the feed water being 100° F., there was left to be furnished by the fuel 1102° F. The total quantity of heat then furnished by the fuel was $146 + 1102 = 1248°$ F., of which 146° was lost by *blowing out*, and 146 is 11·7 per cent of 1248. Out of every 100 of fuel burnt, there is then 11·7 lost, and 88·3 utilized; and if 88·3 give 4·519, 100 would give 5·118. There was therefore evaporated by each pound of bituminous coal, 5·118 pounds of sea-water.

Proceeding in the same manner, there will be found to be evaporated per hour, per square foot of heating surface, 3.624 pounds of sea-water.

As it is possible to attain an evaporation of 8 pounds of water per pound of coal in marine boilers of proper proportions, let us examine why the boilers of the "Iris" gave so inferior a result.

The first essential is, that the fuel be supplied with a sufficient quantity of atmospheric air to oxidize the components of the fuel, and this quantity will mainly be determined by the cross area of the flues or *calorimeter*, modified by amount of heating, or heat absorbing surface and height of smoke chimney.

With the proportion of heating to grate surface of $17\frac{3}{4}$ to 1, and a consumption of 12.812 pounds coal per square foot of grate per hour, the heated gases would be delivered into the chimney at the temperature of about 420° F., the chimney being 40 feet high above the grate, the velocity of draught calculated from Buchanan's formulæ would be 25.8 feet per second.

According to the experiments of Professor Walter R. Johnson on Maryland bituminous coals, the kind used with this boiler, there are required for the perfect combustion of one pound, 237·21 cubic feet of atmospheric air at standard temperature of 60° F., and pressure of 30 inches barometer; there would consequently be required to enter the grates per hour $(237{\cdot}21 \times 12{\cdot}812 \times 80)$ 243,130·76 cubic feet of air, which will contain 48,626·15 cubic feet of oxygen entering into chemical combination with the constituents of the coal.

Of the combined oxygen, the portion that enters into chemical combination with the fixed carbon, compared to that which enters into chemical union

with the bitumen of the coal, (supposing, as is the case with Maryland coals, that the fixed carbon is 75 per cent., and the bitumen 14 per cent., the remainder being earthy matters, &c.,) is in the proportion of 200 to 112; consequently there would unite with the fixed carbon 31,170·6, and with the bitumen 17,455·55 cubic feet of oxygen; and as carbon unites with oxygen by volume in the proportion of $\frac{1}{2}$ to 1, the sum of the volumes would be 46,755·9 cubic feet, which by that union condenses into the original volume of oxygen, viz: 31,170·6 cubic feet.

As hydrogen, the principal constituent of the bitumen, requires only one volume of oxygen to two volumes of itself, the resulting bulk would be 52,336·65 cubic feet, which by the chemical union condense into the original bulk of the hydrogen, viz: 34,891·1 cubic feet.

After the deduction of the 48,626.15 cubic feet of oxygen from the total bulk of air required, viz: 243,130·76 cubic feet, there remains 194,504·61 cubic feet of uncombined nitrogen.

The bulk of gases in the cold state, required to pass through the flues of the boilers per hour, would be $243{,}130{\cdot}76 \times 31{,}170{\cdot}60 \times 34{,}891{\cdot}10 =$ 309,192.46 cubic feet.

Supposing the temperature of the air entering the ash-pits to be 60° F., and that of the heated gases entering into the flues 1060° F., the gases would have received 1000° of temperature; and as the fixed airs expand $\frac{1}{479}$th their bulk for each degree of temperature, the 309,192·46 cubic feet would be increased to 954,688·20 cubic feet.

Now the cross area of the flues is 9·17 square feet, and the velocity of the draft in the chimney per hour is $(25{\cdot}8 \times 60 \times 60)$ 92,880 feet, the bulk of gases passed per hour is then $(92{,}880 \times 9{\cdot}17)$ 851,709·6 cubic feet. Consequently the calorimeter is not large enough to pass the proper amount of air by 12 per cent. were the combustion *perfect;* that is, did *all* the oxygen enter into *full* chemical combination with the constituents of the coal.

In practice, however, this is impossible to effect, from want of time and sufficient mixing of the gases, so as to bring molecule of oxygen in contact with molecule of coal constituent; and analyses of the products of combustion taken from the flues of steam boilers show that 50 per cent. of the entering oxygen passes off uncombined. In *practice*, therefore, the calorimeter should be made double the *theoretical* dimension. The proportion of calorimeter to grate in the boiler of the "Iris" is 1·000 to 8·724; more than double this proportion, or about 1·000 to 4, would therefore be a proper dimension in practice, burning the same amount of coal per square foot of grate per hour.

After having generated the caloric most economically by such a proper proportion of the calorimeter as would allow the oxygen to be present in sufficient quantity to ensure the saturation of the coal constituents, the next thing to be done is to provide a sufficient quantity of heat absorbing surface to conduct it into the water. Here again a much higher proportion than what is usually given in practice, will be found desirable. It can be made as high as 35 or 40 of heating to 1 of grate surface, advantageously—bearing in mind, however, that each addition to the heating surface, by abstracting caloric, reduces the draft, and diminishing the

consumption of coal on the grate per unit of time, diminishes generally, also, the potential, though it increases the economical evaporative result.

Losses of Labor by the Paddle-wheel.—The speed of the vessel being 6·824 knots of 6082⅔ feet, the circumference of the centre of reaction of the paddles 67·60 feet, and the number of revolutions of the wheels per minute 12·491, their slip would be as follows:

$6{\cdot}824 \times 6082\frac{2}{3} = 41508{\cdot}12$ speed of vessel, in feet, per hour.
$67{\cdot}6 \times 12{\cdot}491 \times 60 = 50663{\cdot}50$ " centre of reaction of paddle per hour, in feet.
9155·38 slip per hour, in feet.

Or 18·07 per cent.

The loss by the oblique action of the paddles, calculated as the squares of the sines of their angles of incidence on the water, is 12·89 per cent.

The total losses by the paddle-wheel would then be (18·07+12·89) 30·96 per cent.

The following proportions will be found useful in practice:

Square feet of immersed amidships section of vessel to square foot of paddle		(taking the area of two paddles only)	8·179	to 1·000
Do.	do.	(taking the area of *all* the immersed paddles)	1·817	"
Do.	do.	cubic foot of space displacement of steam piston	2·400	"
Do.	do.	do. per double stroke of piston per minute	0·192	"

For the Journal of the Franklin Institute.

English Modesty.

Our friends across the Atlantic are in a fair way of carrying off all the honors connected with marine navigation, if we allow them to take that liberty unopposed, and the *cool impudence* of the thing is most surprising; for instance, the following article is published in the *Builder* for October 11th, 1851, No. 454, p. 658, claiming that the machinery of the Collins' line of steamers was not only copied from the Cunard line, but that engineers and hands were imported from the Clyde into New York for the purpose of constructing their machinery, and that this was one of the conditions on which the United States government granted the contract to Mr. Collins.

"*British and American Steamers.*—In your number of the 4th inst. you quoted an extract from an American paper, in which it is stated that improvements made in the steam engine by Americans, have been adopted in building the "last fast" boats of the Cunard line, and that in the "extra fast boats" of the same line now in course of construction, "they are to go the whole figure, and fashion the engines entirely after the most approved American models." By giving currency, as you have done on this and other recent occasions, without comment, to the overweening estimate which the Americans form of their own superiority, you appear to me, Mr. Editor, to do much towards weakening the well-founded confidence which has hitherto been entertained in the perfection of British machinery, thereby injuring British interests, particularly with reference to the demands for engines from foreigners.

It is time, therefore, that the real facts of the case respecting the manufacture of the engines on board Collins' American line of steamers (the vessels more immediately alluded to in the American newspaper) should be made known, which I now do from undoubted authority, and, as regards some of the particulars, from my own knowledge,—and which are as follows:—

The United States Government, perceiving the failure of all the attempts that had been made to establish an American line of Atlantic steamers, which should compete in point of speed and efficiency with the Cunard line, and deeming it of the greatest national importance that this inferiority should no longer continue, subsidized, with a large annual subvention, Collins' line, (besides, it is believed, giving pecuniary aid in some shape or other towards the construction of the vessels,) on condition that no expense should be spared in obtaining the most perfect and efficient engines that could be constructed; and

as there was at that time (although it is only two years ago) no manufacturer in the United States who could make engines fulfilling these conditions, the contractors for the American line turned their views towards the Clyde, and obtained permission from the proprietors of the Cunard line to take mouldings or castings of every part, even to the minutest particular, of the engines constructed by Napier, of Glasgow, on board the largest of their vessels; and in order that nothing might be wanting to make the engines equal to those in the Cunard steamers, the contractors imported men from the manufactories on the Clyde for the purpose of making the engines in New York, so that they might be of national or American fabric.

As, therefore, the last constructed and fastest of the American or ocean-going steamers are made entirely after the British model and by "Britishers," you will perceive, Mr. Editor, how little likely it is that the Cunard vessels now in course of construction are to be fitted with engines made after the American model. Where, indeed, have the Americans anything better to show than the engines on board the Collins' line, which are made after the British model? BRITANNICUS."

There is not *one word* of truth in the above article, so far as it relates to the construction of the machinery of the Collins' steamers, and it has emanated from one who is entirely ignorant of what he is writing about, and in his zeal to protect the credit of the Cunard line for speed, has either ignorantly, or by design, written the article to blind his countrymen as to the truth, for it is *rather* mortifying to be beat by Brother Jonathan on a field that two years since was controlled entirely by Great Britain. Now for a few facts; the machinery for the Atlantic and Arctic was designed and constructed at the Novelty Works, New York, whose engineer, T. B. Stillman, Esq., (the senior member of the firm) is a Yankee from the valley of the Mohawk, and I am quite positive has never visited England, at any rate has not been there for the last five years. The engines for these two ships were designed and constructed under his immediate supervision. The engines for the Pacific and Baltic were constructed at the Allaire Works, and were designed by Charles W. Copeland, Esq., engineer of the works, (another Yankee from Connecticut,) and constructed under his supervision. The chief engineer of the line, John Faron, Esq., was I believe born in Ireland, and came to this country when about two years old, at which time we may fairly infer he had not imbibed many ideas on marine navigation. Mr. F. was superintending engineer on the part of Mr. Collins, and it is understood, designed the boilers of all the vessels.

If the writer in the *Builder* can from the above statement, (which is strictly true,) make out that the engines were copied from the Clyde, and designed and built by English engineers, I should be happy to hear his argument. I can, however, I think, give him a hand to help him out of his dilemma. The engines of the Ohio and Georgia, Chagres and New Orleans steamers, were designed by an engineer from the Clyde, (Mr. Tothill,) and constructed under his supervision at the then works of T. F. Secor & Co., (now Morgan Iron Works,) New York; they are of the same size and have a strong resemblance to the engines of the Cunard steamers Europa and Niagara, but are improved in having balance valves, by which one man can work each engine, instead of requiring three, the usual practice on the Clyde. The boilers are also essentially different from those of the English steamers.

Those who pay any attention to the English papers, must well remember that it was a long time before *they* would admit that the Collins'

line were the equal in speed of the Cunard steamers; but now that they are obliged to admit the truth, and own that they are beaten, they turn round with all the coolness imaginable, and actually call it a triumph of English engineering.

What they have claimed as to the Collins' steamers, they are now asserting in relation to the yacht America. Most persons on this side of the Atlantic have supposed that she was built by William H. Brown, Esq., of New York, and that she was designed by his foreman, Mr. Steers, and that good or bad, she was truly the production of this country; they have also the impression, that while building, drawings were taken of her on the stocks, and published in several of the English papers, and that those papers all spoke of her peculiar form, and not one of them claimed her as being built from an English model; but all this was before the race; no sooner is that over, than several English papers discover a very strong resemblance to some of the fishing boats on their coast; others are more definite, for instance, the *London Mechanics' Magazine*, October number, page 289, says, "It turns out that among other novelties, she had *sliding keels*, and probably this contributed not a little to her triumph. Sliding keels, however, are well known to have been the invention of the late British Admiral Sir John Schank."

Now it is a well known fact, in this country at least, that the use of centre boards or sliding keels, as they are termed in England, dates farther back than the memory of the oldest inhabitant, and at the risk of disturbing the ashes of Sir John Schank, I must say he had nothing to do with their invention in this country; nearly every river sloop in the vicinity of New York, at least as long back as the memory of man goeth, used them, and the date of their invention was as great a mystery then as now. Another English writer says, the America is modelled on the wave principle, and therefore she is an English model, because Mr. John Scott Russell is the inventor of the system; that Mr. Russell has done much to beat a little common sense into the heads of some of the ship builders of England, I allow. He has undoubtedly for years past seen, that while the models of our ships were being constantly improved, yet in England they were all but stationary, and an English merchantman could be readily told from her build, no matter what flag she might carry or how much they might attempt to disguise her. There has not been during the last twenty years a single English regular packet ship trading to this country, their inferiority being universally conceded. Mr. Russell, fully aware of this, has adopted essentially the theory and practice of some of our best builders; that he *thinks* he is original in his ideas, I am willing to admit, for I have watched for years past his efforts, and he may perhaps claim the merit of being the originator so far as his own country is concerned; but when he claims, *as he is now doing*, that we are adopting *his ideas*, it is carrying the joke too far. In the *London Architect* for August, Mr. Russell claims, that his system has been generally adopted in this country; that our present practice and Mr. Russell's may assimilate is quite possible, but ours has been of a gradual native growth, and if it has any merit it belongs to our own ship builders, with whom it originated, and who have gradually carried it forward to its present position of triumph. Mr. Russell states, that the yacht *Titania*, the competitor of the America,

was modelled on his system, which I am glad to know, as the two vessels being essentially different, he cannot then claim the America.

The next move, I suppose, will be to call Com. Stevens, who sailed the America, an Englishman, and then the whole thing will be complete. How contemptible is that spirit that cannot see good in another; for my part, I allow that we have gained much knowledge from an examination of the machinery of the various English steam ships that have visited us, and this kindness we shall fully repay by teaching brother John how to model a ship. B.

For the Journal of the Franklin Institute.

Remarks on J. W. Nystrom's Remarks on the Propeller and Steam Engine of the War Steamer "San Jacinto." By J. V. Merrick.

The readers of this Journal, in perusing various calculations and remarks inserted on former occasions in its pages by Mr. J. W. Nystrom, on the subject of Marine Propulsion, may have been a little surprised at the facility with which sundry disputed points were disposed of, and observed results of experience set at nought, when brought to the *test* of theory, unsupported either by proof or probability. Without desiring in this connexion to quarrel with the positions taken by Mr. N. in his former articles, I feel too much interest in the subject of his last one, (in the Dec. No., pp. 402-404,) to forbear venturing a word or two regarding some remarks he has therein seen fit to make on a Report of the recent trial trip of the U. S. steamer San Jacinto; in the course of which remarks we are gravely informed that the "slip" is falsely reported, because it does not correspond with the result of an empirical formula, and with his opinion of what *ought to be* the slip under the circumstances. Happening to know some of the facts of this case, I can inform Mr. Nystrom that not only is the slip of the San Jacinto correctly reported by Mr. Isherwood, (that is, if any reliance is to be placed on the Charts of the U. S. Coast Survey, and the observed time, compared by several competent and disinterested individuals,) but that furthermore, other instances might be adduced to show that $26\frac{1}{4}$ per cent. slip is not remarkable, as being either very small or very great, in a vessel of her resistance and propelling area; but is simply about what might be predicted, by those who predicate their judgment on former experience. It may also be observed that, so far from anticipating a passage from Liverpool to Halifax in 5·78 days, because her propeller has a slip of only $26\frac{1}{4}$ per cent. in still water, it is much more likely that the San Jacinto will not accomplish it in less than ten days. To appreciate the force of Mr. N.'s argument, it is merely necessary to suggest, 1st, that heavy weather at sea, or even a very slight swell, is, unfortunately, apt to increase the slip of all propelling agents; and, 2d, although Mr. N. announces that "there would be no difficulty in giving the propeller 50 revolutions per minute," it is almost certain that not even 31 revolutions (the number on the trial) will ever be attained at sea, when the ship has her full supply of coals, provisions, and stores, and where the water is rarely at rest. It would be easy by such a mode of calculation, to argue a six days' passage as possible for the Col-

lins' steamers; because if there is "no difficulty" in giving their paddle wheels an increased number of revolutions in the ratio of 31 to 50: then, as the Pacific has already accomplished the trip in 9 days 20 hours, she of course can do it in $\frac{9{\cdot}83 \times 31}{50} = 6{\cdot}1$ days. It is scarcely necessary to say that the difficulty in the way of speed exists precisely in this point; the number of revolutions can *not* be increased ad libitum.

But there is another remark which calls for notice. Mr. N., to demonstrate that slip is not loss of effect, says, after calculating what would be the vessel's speed if there were no slip, that, "as there is no slip in the water, the propeller is of no use for propelling the vessel; it can as well be taken off, and the remainder will be 375·92 horse power from the *steam engine, which will drive the vessel* 15 *miles an hour with no propeller!!!*"

Admitting the principle involved in this declaration, it is equally clear that wheels are entirely unnecessary to the functions of a locomotive engine, because in that case there is no slip, and consequently the wheels may be taken off, and the remainder will be the whole effective power of the engine, which will drive the locomotive at — miles per hour, *without wheels.*

Is it necessary to remind Mr. N., that "slip" is nothing more than recession of the fulcrum against which the paddle or propeller blade acts? and that therefore the loss involved in it, is a loss of space passed over in a given time; hence a loss of velocity; and therefore that it is what is commonly called "loss of effect," or more correctly speaking, loss of useful effect.

This article has already so far transcended the limits within which I had proposed to retain it, that for the demonstration of the above stated principle, I must appeal to the reflection of Mr. Nystrom, and of those (if any) who, persuaded by his denial, may have allowed themselves for a moment to doubt the truth of a theory so well established.

For the Journal of the Franklin Institute.

Practical Rule for finding the Thickness of Cast Iron Water Pipes. By John C. Trautwine, *Civ. Eng.*

Books afford to practical men no guide by which to determine the thickness of cast iron pipes for resisting the pressures of different heads of water. Most authors who allude to the subject, content themselves with merely giving theoretical rules, which are well known to furnish results entirely too low for use in practice.

Thus, Barlow's Rule gives, for a 16-inch pipe to support a head of 100 feet, a thickness of but $\frac{1}{100}$th part of an inch, or about twice that of a sheet of ordinary letter paper.

Other writers, again, give the results of some very incomplete experiments, altogether too limited in number to serve as general data; while others either pass over the subject in silence, or at most, with an intimation that it admits of no specific instructions.

The fact that the theoretical thicknesses are so entirely insufficient for

practice, appears to have deterred scientific men from a more thorough investigation of the cause; and practical ones have, in consequence, been compelled to adopt such limited results of experience as they could chance to obtain, taking care generally to err on the safe side. In some instances, this precaution has been attended with useless expenditures of heavy sums of money.

The principles involved in the investigation of this subject, although presenting difficulties to a scientific solution, admit, as I conceive, of a simple and sufficiently satisfactory one in practice.

Mr. Barlow, in giving his Rule, (see the Transactions of the Institution of Civil Engineers,) assumed the *safe* cohesive strength of cast iron at 18,000 pounds per square inch; but Hodgkinson has since conclusively shown by numerous experiments, that it is not safe to employ more than 15,000 pounds per square inch as the *ultimate* cohesive strength of ordinary cast iron. This being the case, I have assumed 5000 pounds per square inch as the *safe* limit for water pipes, abstractedly considered; and modifying Barlow's Rule in this particular only, have prepared the following table. But it will be evident to any one practically conversant with the subject, that even the thicknesses given by the table are not sufficiently great for actual use, and the question arises, why are they not so? The answer appears to be simply this—that in the smaller pipes a greater thickness is necessary to ensure safety from breaking while being transported, handled, and laid; and that, in both small and large ones, it is extremely difficult to cast them of the proper lengths, and at the same time of an *uniform thickness*, and without more or less imperfection from air bubbles, &c. Consequently an excess becomes necessary, in order to counteract these sources of weakness. Moreover, after the pipes are laid, the soil below them may settle unequally, and a greater or less length of pipe may thus become a kind of tubular girder, sustaining the mass of earth which rests upon its upper side.

From a careful examination of a great number of instances collected from various sources, I conceive that I am warranted in asserting that the additional thickness required to guard against irregularities in the casting, will at the same time suffice for security in handling, and for as great a resistance to fracture, from unequal settlement, as we shall find it expedient to aim at in ordinary practice. Any attempt to obviate the last difficulty *entirely*, would in many cases be attended with an expense so great as to restrict the use of water pipes within very narrow limits. It is generally advisable, therefore, not to make the attempt, but to submit to the *comparatively* trifling inconvenience of those occasional fractures which almost invariably attend the execution of extensive systems of water pipes.

Water pipes of the usual length of about 9 feet, cannot well be cast of a less thickness than $\frac{3}{8}$-in., and in very large pipes, $\frac{5}{8}$-in. is not too great an excess over the calculated thickness, to allow for irregularities and defects in the castings. Therefore, I will venture to offer the following as a practical rule for the thickness of cast iron pipes, to sustain safely different heads of water under ordinary circumstances, viz:

To the thicknesses given in the following table, add $\frac{3}{8}$-in. for all pipes under 12 inches diameter; $\frac{1}{2}$-in. for those of from 12 to 30 inches; and $\frac{5}{8}$-in.

for those of from 30 *to* 48 *inches diameter. Or, if it should be considered expedient to allow something for* rusting, *add respectively,* $\frac{1}{2}$, $\frac{5}{8}$, *and* $\frac{3}{4}$*-in., instead of* $\frac{3}{8}$, $\frac{1}{2}$, *and* $\frac{5}{8}$*-in.*

Inner diameter or bore of Pipe in inches.	HEAD OF WATER IN FEET.															
	100	150	200	250	300	400	500	600	800	1000	1200	1400	1600	2000	2500	3000
	Pressure of Water against sides of Pipe, in pounds per square inch.															
	43·4	65·1	87	109	130	174	217	260	347	434	521	608	694	868	1085	1302
	Thickness of Pipe in inches.															
2	·009	·013	·018	·022	·027	·036	·045	·055	·075	·095	·116	·139	·161	·210	·277	·352
3	·013	·020	·026	·033	·040	·054	·068	·082	·112	·143	·173	·207	·242	·315	·417	·530
4	·017	·026	·035	·045	·053	·072	·090	·110	·149	·191	·232	·278	·322	·420	·555	·704
5	·022	·033	·044	·056	·067	·090	·113	·137	·186	·237	·290	·347	·402	·525	·695	·880
6	·026	·040	·053	·067	·080	·108	·136	·165	·224	·287	·347	·415	·485	·630	·835	1·06
7	·030	·046	·062	·078	·093	·126	·159	·193	·261	·333	·406	·485	·565	·735	·970	1·23
8	·034	·053	·071	·089	·107	·144	·181	·220	·298	·382	·465	·556	·614	·840	1·11	1·41
9	·039	·059	·079	·101	·120	·163	·205	·247	·335	·427	·520	·622	·724	·945	1·25	1·58
10	·044	·066	·089	·112	·134	·181	·227	·275	·373	·475	·580	·695	·805	1·05	1·39	1·76
12	·053	·080	·106	·134	·161	·217	·273	·330	·448	·575	·695	·830	·970	1·26	1·67	2·12
14	·061	·093	·124	·156	·187	·253	·318	·387	·523	·666	·813	·970	1·13	1·47	1·94	2·47
16	·069	·106	·142	·178	·214	·288	·363	·440	·596	·763	·930	1·11	1·29	1·68	2·22	2·82
18	·078	·120	·159	·201	·242	·326	·409	·495	·670	·850	1·04	1·24	1·45	1·89	2·50	3·18
20	·088	·132	·177	·223	·267	·361	·454	·549	·746	·950	1·16	1·39	1·61	2·10	2·77	3·52
24	·105	·159	·213	·268	·321	·433	·545	·660	·895	1·15	1·39	1·66	1·94	2·52	3·33	4·23
30	·132	·198	·267	·336	·402	·543	·681	·825	1·12	1·42	1·74	2·08	2·41	3·15	4·17	5·28
36	·156	·238	·318	·402	·483	·651	·819	·990	1·34	1·71	2·08	2·49	2·91	3·78	5·01	6·36
42	·184	·279	·372	·469	·562	·759	·955	1·16	1·57	2·00	2·44	2·91	3·39	4·41	5·83	7·42
48	·210	·317	·425	·535	·641	·866	1·09	1·32	1·79	2·29	2·79	3·32	3·87	5·04	6·65	8·45

Barlow's Rule.—Multiply the pressure against the inner diameter of the pipe in pounds per square inch, by half the inner diameter in inches, and divide the product by the difference between the cohesion of the metal per square inch, (assumed in the above table at 5000 lbs.,) and the pressure in pounds per square inch. The quotient will be the required thickness in inches.

Seasoning Timber. *By* Samuel Clegg, Jr.*

Seasoning timber is the extraction of all the vegetable juices and moisture from the woody fibre, leaving it perfectly dry and free from the effects of that unequal expansion and contraction of moisture between the fibres which causes timber to warp, twist, and crack. Seasoning is effected by natural and artificial means.

Timber loses both in dimensions and weight by seasoning, as shown in the following table of experiments, instituted in order to ascertain the weight of a cubic foot of different kinds of wood,—the foreign when first imported, those of the growth of England when felled, also the weight of each when fully seasoned, showing at the same time *the loss sustained in dimensions during the process of seasoning.*

* From the London Architect, for September, 1851.

Table of Experiments by Mr. Benjamin Couch, *of Plymouth Dockyard.*

Species (in the language of commerce.)	Country where produced.	What part of the tree the pieces experimented on were cut from.	Dimens'ns when first planed: Length. Ft.	In.	Breadth and thickness, or diameter. Inches.	Dimensions when seasoned: Length. Ft.	In.	Breadth and thickness, or diameter. Inches.	Weight in air of a cubic foot in ounces avoirdupois: When first planed. oz.	When seasoned. oz.
Riga masts, supe'or	Russia	Butt*	7	6	18 diameter.	7	6	$17\frac{3}{4}$ diameter.	672	644
		Top	4	5	11 × 11	4	5	$10\frac{13}{16} \times 10\frac{3}{4}$	516	552†
Riga masts, infe'or	Ditto	Butt	12	0	12 diameter.	12	0	$11\frac{7}{8}$ diameter.	577	494
		Top	6	6	$8\frac{3}{4}$ diameter.	6	6	$8\frac{1}{2}$ diameter.	464	464
Pitch pine mast	Baltimore, N. America	Butt	2	6	10 × 10	2	6	$9\frac{3}{4} \times 9\frac{3}{4}$	755	741
		Top	6	0	$7\frac{1}{2} \times 7\frac{1}{2}$	6	0	$7\frac{3}{8} \times 7\frac{3}{8}$	518	524
Yellow pine mast	Canada	Butt	2	4	18 × 18	2	4	$17\frac{7}{8} \times 17\frac{7}{8}$	683	461
		Top	5	0	16 × 16	5	0	$15\frac{7}{8} \times 15\frac{7}{8}$	495	420
White pine mast	New Brunswick .	Butt	3	11	12 × 12	3	11	$11\frac{15}{16} \times 11\frac{7}{8}$	679	436
		Top	3	11	8 × 9	3	11	$7\frac{15}{16} \times 8\frac{15}{16}$	411	368
Red pine mast	Canada	Butt	2	0	12 × 12	2	0	$11\frac{3}{4} \times 11\frac{3}{4}$	672	569
		Top	14	0	11 × 9	14	0	$10\frac{5}{8} \times 8\frac{3}{4}$	570	503
Oak	England	Butt	1	10	$12 \times 11\frac{3}{4}$	1	10	$11\frac{5}{8} \times 11\frac{3}{8}$	1113	743
		Top	2	0	$6\frac{1}{2} \times 6$	2	0	$6\frac{3}{16} \times 5\frac{3}{4}$	1071	777
Elm	Ditto	Uncertain.	4	0	11 × 11	4	0	$10\frac{3}{4} \times 10\frac{3}{4}$	940	588

* The butts and tops were cut from the same tree.

† Should it be asked, why a cubic foot of some of the pieces increases in weight in *seasoning?* the reason is, that they lost more in dimensions than in weight during that process.

For further information, see Barlow "On the Strength of Materials."

It will be perceived that in *length* no variation takes place, but in width the shrinkage is considerable; therefore it is that joints in floors, &c., laid with unseasoned timber, open, notwithstanding they may have been left quite close by the workman.

Natural seasoning is effected by removing the timber from where it has been felled as soon as possible, (the sooner the better,) and placing it in an inclined position in a dry situation, where the air may circulate freely round it; but it should not be exposed either to the sun or wind, as the unequal action caused by either would give the timber a tendency to split, by irregular drying. The lower edge of the timber should not touch the ground; and if there is more than one piece they must have air space between them. If timber can be kept for some time in a dry situation before it is cut into scantlings, it is less subject to warp and twist in drying. Lately, in some of the government yards, the timber has been laid upon cast iron bearers, instead of being laid upon refuse pieces of wood, as the refuse wood may be half rotten, and then must, in some degree, contribute to infect the sound timber. Timber, when converted into scantlings, still requires attention, even though the log from which it was cut was seasoned. It should be piled in a sloping direction, with space for air all round each piece. A drying yard should be well drained, and on no account should pools of water be allowed to stand on it. For the general purposes of the engineer, timber should be in seasoning two years before use. For joiner's work, Mr. Tredgold says four years should elapse, unless other methods than natural seasoning be resorted to.

Immersion in water has been said to facilitate the process of seasoning. Newly-cut timber placed some twelve or fourteen days entirely under water and then dried in the sun and wind, is rendered less liable to warp and crack; but it loses somewhat in strength. *Partial* immersion is destructive to timber. The theory of water-seasoning seems to be, that sap being soluble, its fermentable properties are lessened by dilution.

Seasoning timber by steaming or boiling is dangerous, for hot water, or steam, has to some extent the power of dissolving the woody fibre. Mr. Barlow says: "Although there is an obvious falling off in the strength of timber boiled for a long time, the defect is very small while the boiling or steaming is not continued beyond the proportion of an hour to an inch in thickness, which is the usual practice in the dockyards."

Davison's desiccating process for drying and seasoning timber will be found explained in the *Civil Engineer and Architects' Journal*, Vol. XII., p. 310. Heating timber in a chamber furnished with flues facilitates the evaporation of the watery particles; but heat is not the only essential required for drying—a current is likewise necessary; otherwise all the water which is thus converted into vapor will only tend to charge the chamber with steam, and it is not until this steam has arrived at a certain pressure, that it will make its escape, and the operation of drying commences. It is not only a moving, but a *rapid*, current which is the great desideratum for all drying purposes; and it is the impulsion of atmospheric air through the chamber at any required velocity, by means of a fan combined with heat under perfect control, which constitutes the desiccating process. The greener the wood the easier and more perfect is the expulsion of moisture; and at the same time, the native strength of the fibre is secured

by the immediate evaporation of all vegetable juices and moisture likely to ferment and carry on decomposition. The gums, instead of being removed, are coagulated and hardened, and the texture of the wood generally is less liable to decay. Shrinkage is said to be entirely obviated. The cost of desiccating does not exceed the interest of money sunk in laying up wood to season in the ordinary way. Timber seasoned by desiccation has its strength increased; and compared with that seasoned in the ordinary way, yellow pine is said to be increased in strength 17·6 per cent., Riga fir 20·4, and oak 14·0 per cent.

In reference to impregnating timber with any substance to preserve it from decay, that which has been completely exhausted of aqueous particles by the desiccating process is in the best possible condition to receive such substances; but more especially if timber, instead of being allowed to cool after it is removed from the desiccating chamber, is immediately plunged into a cold antiseptic.

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*Unequal Refraction.**

On Sunday, the 14th of September, there occurred in this neighborhood—five or six miles north-east from Harwick, N. B.—a striking example of unequal refraction. At about a quarter past five in the morning, the figure of a man was seen, quite distinctly, walking in the air, at a very considerable elevation above the ground. A man and a boy walking together first noticed the appearance; and in about ten minutes after they had seen it, pointed it out to a third person.

The representation is described as being that of an old man, dressed in dark-colored clothes and an old-fashioned broad bonnet, with a walking-stick in his hand; and, when first seen, appearing to be about half a mile distant, and magnified to eight or ten feet in height. The figure was so distinct, that the nose and other features were seen; and every motion made in walking—such as the flapping of the coat-tails, the handling of the stick, stooping as if to pick up something from the ground, taking off the bonnet and wiping the forehead—was as plainly exposed as if performed by a man walking on *terra firma*, and at the same apparent distance. When first seen, the object was nearly due east, elevated at about an angle of twenty degrees, and exposed against the clear morning sky—lit up, as it was, by the rays of the approaching sun.

The observers occupied a position of very considerable altitude, and which affords an uninterrupted view across the country for fifteen or twenty miles, when it is closed by Cheviot Mountain, which lay directly in range of the object, though far below it. The course pursued by the aerial walker was north-easterly and descending; so that, at one time, he gradually disappeared altogether, the head and shoulders remaining in view some time after the lower parts had vanished. After the spectators had walked on about a mile farther, however, their course lying north-north-west, the phenomenon again became distinctly visible; and as they had been ascending, so it appeared correspondingly higher above the horizon. It was then followed by a dog, which, however, from dis-

* From the London Athenæum, September, 1851.

tortion or some other cause, could scarcely be distinguished from a sheep, only its ears appeared larger and more erect.

All this time there never appeared any ground along with the figure, which stalked with long leisurely strides athwart the clear sky; and when last seen, and when it had descended nearer to the horizon, became tinged of a lurid red by the rays of the sun, and appeared cut in two by a stripe of red cloud. From first to last, the spectacle was seen for about the space of half an hour; and when in view the second time, it appeared to be much farther off than at first—perhaps about two miles distant—though, strange to say, still distinctly and minutely visible. There would appear to have been some optical illusion or misconception as to the distance of the object; and nothing, as yet, is known of its corporeal representative.

For the Journal of the Franklin Institute.

A Series of Lectures on the Telegraph, delivered before the Franklin Institute. Session, 1850–51. *By* Dr. L. Turnbull.

Continued from Vol. xxii, page 415.

Printing Telegraph of Alfred Vail.

The printing telegraph of Alfred Vail was proposed in September, 1837. It consists of a type wheel having on its surface the twenty-four letters of the alphabet. On the side of the wheel are twenty-four holes. The type wheel is moved circularly by means of a spring that the electro-magnetic key causes to advance at each interruption and return of the current. The paper advances under the type wheel by means of an independent clock movement.

The precision of the operation depends on the exact correspondence of the machinery, situated at the two extremities of the telegraphic lines. It is necessary that the type wheel presents the same letter at both stations, and that the clock moves at the same rate. But I believe that this system has never been put in execution. I copy from p. 169 of his work on the telegraph, the conclusions he comes to in regard to this form of telegraph:

"All electro-magnetic telegraphs require as their basis, the adoption of the *electro-magnet*, when recording the intelligence is an object, and it would seem, must be applied in a manner equivalent to the mode adopted by Prof. Morse; that is, the application of the armature to a lever, and its single movement produced by closing and breaking the circuit. It is, therefore, safe to assume that, whatever improvement in one plan may be made to increase the rapidity of the movements of those parts of the telegraph which belong to the electro-magnet, is equally applicable to any other plan, provided too much complication, already existing, does not counteract and defeat the improvement.

"Some plans, however, use an extra agent besides the electro-magnet, which is employed for measuring the time of the revolution of the type wheel, and the electro-magnet is only called in, occasionally, to make the impression. In such plans the rapidity of communication demands the

combined action, alternately, of both magnets. This, of course, increases the complication, and must certainly be considered a departure from other more simple arrangements. Whatever will reduce the inertia of mechanical movements and bring them to act with an approximate velocity, at least of the fluid itself, will increase the rapidity of transmission. The more the instrument is encumbered with the sluggish movements of material bodies, the less rapid, inevitably, must be its operation, even where several co-operating agents are assisting, in their respective spheres, to increase the rapidity of the motion. Such is the case with the several kinds of letter printing telegraphs: very weighty bodies, comparatively speaking, are set in motion, stopped, again set in motion, and along with this irregular motion, other parts perform their functions. There must be a courtesy observed among themselves, or matters do not move on as harmoniously as could be desired. This is not always the case, especially where time is the great question at issue.

"All printing telegraphs which use type, arranged upon the periphery of a wheel, must have, of necessity, these several movements, viz: the irregular revolution of the type wheel, stopping and starting at every division or letter; the movement of the machinery, called the printer; the irregular movement of the paper, at intervals, to accommodate itself to the letter to be printed; the movement of the inking apparatus, or what is not an improvement in cleanliness, paper of the character used by the manifold letter writer. So many moving parts, are so many impeding causes to increased rapidity, and are, to all intents and purposes, a *complication.*

"The requirements of a perfect instrument are: economy of construction, simplicity of arrangement, and mechanical movements, and rapidity of transmission. To use one wire is to reduce it to the lowest possible economy. If there is but one movement, and that has all the advantages which accuracy of construction, simplicity of arrangement and lightness, can bestow upon it, we might justly infer that it appeared reduced to its simplest form.

"The instrument employed by Prof. Morse has but a single movement, and that motion of a vibratory character; is light and susceptible of the most delicate structure, by which rapidity is insured; the paper is continuous in its movement, and requires no aid from the magnet to carry it.

"The only object that can be obtained by using the English letters, instead of the telegraphic letters, is, that the one is in common use, the other is not. The one is as easily read as the other; the advantage then is fanciful, and is only to be indulged in at the expense of time, and complication of machinery, increasing the expense, and producing their inevitable accompaniments, liability of derangement, care of attendance, and loss of time."

Alexander's Electric Telegraph.

I copy this account of Alexander's telegraph from the *London Mechanics' Magazine*, of November, 1837, but it was copied originally from the *Scotsman*, a paper published in Edinburgh, perhaps a month before, and a model to illustrate the nature and the operation of the telegraphic

machine, was exhibited at a meeting of the Society of Arts in Edinburgh, in October, 1837.

The model consists of a wooden chest, about five feet long, three feet wide, three feet deep at the one end, and one foot at the other. The width and depth in this model are, those which would probably be found suitable in a working machine; but it will be understood that the length in the machine may be a hundred or a thousand miles, and is limited to five feet in the model, merely for convenience. Thirty copper wires extend from end to end of the chest, and are kept apart from each other. At one end, (which for distinction's sake, we shall call the south end,) they are fastened to a horizontal line of wooden keys, precisely similar to those of a piano-forte; at the other, or north end, they terminate close to thirty small apertures equally distributed in six rows of five each, over a screen of three feet square, which forms the end of the chest. Under these apertures on the outside, are painted in black paint upon a white ground, the twenty-six letters of the alphabet, with the necessary points, the colon, semicolon, and full point, and an asterisk to denote the termination of a word. The letters occupy spaces about an inch square. The wooden keys at the other end have also the letters of the alphabet painted on them in the usual order. The wires serve merely for communication, and we shall now describe the apparatus by which they work. This consists, at the south end, of a pair of plates, zinc and copper, forming a galvanic trough, placed under the keys; and at the north end of thirty steel magnets, about four inches long, placed close behind the letters painted on the screen. The magnets move horizontally on axes, and are poised within a flat ring of copper wire, formed of the ends of the communicating wires. On their north ends they carry small square bits of black paper, which project in front of the screen, and serve as opercula or covers to conceal the letters. When any wire is put in communication with the trough at the south end, the galvanic influence is instantly transmitted to the north end; and in accordance with a well known law discovered by Œrsted, the magnet at the end of that wire instantly turns round to the right or left, bearing with it the operculum of black paper, and unveiling a letter. When the key A, for instance, is pressed down with the finger at the south end, the wire attached to it is immediately put in communication with the trough; and the same instant the letter A at the north end is unveiled by the magnet turning to the right, and withdrawing the operculum. When the finger is removed from the key, it springs back to its place, the communication with the trough ceases, the magnet resumes its position, and the letter is again covered.

Thus, by pressing down with the finger, in succession, the keys corresponding to any word or name, we have the letters forming that word or name exhibited at the other end; the name, *Victoria* for instance, which was the maiden effort of the telegraph on Wednesday evening. In the same way we may transmit a communication of any length, using an asterisk or cross, to mark the division of one word from another, and the comma, semicolon, or full point, to make a break in a sentence, or its close. No proper experiment was made while we were present to determine the time necessary for this species of communication, but we have reason to believe, that the letters might be exhibited almost as rapidly

as a compositor could set them up in type. Even one-half or one-third of this speed, however, would answer perfectly well.

Galvanism, it is well known, requires a complete circuit for its operation. You must not only carry a wire to the place you mean to communicate with, but you must bring it back again to the trough. (The writer of this communication, and even Mr. Alexander, was not aware of the discovery of Steinheil, that the earth would conduct so as to return the current without the use of the second wire.—L. T.) Aware of this, our first impression was, that each letter and mark would require two wires, and the machine in these circumstances having sixty wires instead of thirty, its bulk and the complication of its parts would have been much increased. This difficulty has been obviated, however, by a simple and happy contrivance. Instead of the return wires, extending from the magnet back to the keys, they are cut short at the distance of three inches from the magnet, and all form a transverse copper rod, from which a single wire passes back to the trough, and serves for the whole letters. The telegraph, in this way, requires only thirty-one wires. We may also mention, that the communication between the keys and the trough is made by a long narrow basin filled with mercury, into which the end of the wire is plunged when the key is pressed down with the finger.

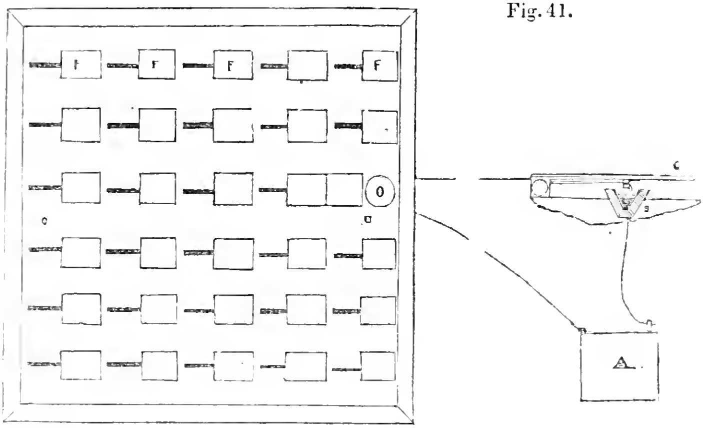
The telegraph thus constructed, operates with ease and accuracy, as many gentlemen can witness. The term model, which we have employed, is, in some respects, a misnomer. It is the actual machine, with all its essential parts, and merely circumscribed as to length by the necessity of keeping it in a room of limited dimensions. While many are laying claim to the invention, to Mr. Alexander belongs the honor of first following out the principle into all its details, meeting every difficulty, completing a definite plan, and showing it in operation. About twenty gentlemen, including some of the most eminent men of science in Edinburgh, have subscribed a memorial, stating their high opinion of the merits of the invention, and expressing their readiness to act as a committee for conducting experiments upon a greater scale, in order fully to test its practicability. This ought to be a public concern; a machine which would repeat in Edinburgh, words spoken in London, three or four minutes after they were uttered, and continue the communication for any length of time, by night or by day, and with the rapidity which has been described; such a machine reveals a new power, whose stupendous effects upon society no effort of the most vigorous imagination can anticipate.

The principle of Alexander's telegraph is represented in the following illustration from the work of Alexander Bain, Esq., fig 41. It consists of but one circuit, so as to make the operation intelligible.

A is a voltaic battery; B, a trough filled with mercury; C, a key to be pressed down by the finger of the operator; *e*, is the end of a conducting wire, which dips into the mercury when the key is depressed, and completes the electric circuit; D D, is the distant dial upon which the signals are to be shown; F F, are screens, thirty in number, each being fixed to a needle, corresponding to the finger keys before described. When no electricity is passing, these screens remain stationary over the several letters, &c., and conceal them from view; but when a current is made to flow, by the depression of a key, the corresponding needle, in

the distant instrument, is deflected, carrying the screen with it, and uncovering the letter, which becomes exposed to view, as at O.

Fig. 41.



In the same Magazine, there is an improvement suggested by a correspondent, which is obvious and a good one, namely, the use of fifteen wires to represent two letters, thus: let each of the letter screens affixed to the movable magnets be wide enough to cover two letters. Then the positive end of the galvanic battery being connected with the inducing wire, by a touch of the keys, the magnet and screen will move in one direction and discover one letter. The negative end of the battery being thus connected with the same wire, the magnet will move in the contrary direction, and discover the other letter. There must, of course, be something fixed to prevent the magnet going so far in either direction as to discover both letters. The returning wire connected with all the other thirty, must of course have its connexion with the battery poles reversed, at the same time as the lettered wire. To prevent oscillation, let each wire act upon two magnets and screens, one magnet and screen moving in one direction, but prevented from moving in the other as now. The current of electricity if reversed, would, on account of this prevention, not move this magnet and screen in the opposite direction, but it might the other magnet and screen having a similar stop or prevention, but placed on the other side of the pole.

Davy's Needle and Lamp Telegraph.

This telegraph is called the needle and lamp telegraph, to distinguish it from the telegraph of Edward Day, which I will describe in a future lecture.

"There is a case, which may serve as a desk to use in writing down the intelligence conveyed; and in this, there is an aperture about sixteen inches long, and three or four wide, facing the eyes, perfectly dark. On this the signals appear as luminous letters, or combinations of letters, with a neatness and rapidity almost magical. The field of view is so confined, that the signals can be easily caught and copied down without the necessity even of turning the head. Attention, in the first instance, is called by three strokes on a little bell; the termination of each word is indica-

ted by a single stroke. There is not the slightest difficulty in decyphering what is intended to be communicated.

"In front of the oblong trough, or box, described by your correspondent, a lamp is placed, and that side of the box next the lamp is of ground glass, through which the light is transmitted for the purpose of illuminating the letters. The oblong box is open at the top, but a plate of glass is interposed between the letters and the spectator, through which the latter reads off the letters as they are successively exposed to his view. At the opposite side of the room, a small key board is placed, (similar to that of a piano forte, but smaller,) furnished with twelve keys; eight of these have each three letters of the alphabet on their upper surfaces, marked A, B, C; D, E, F; and so on. By depressing these keys in various ways, the signals or letters are produced at the opposite desk, as previously described; how this is effected is not described by the inventor, as he *intimated* that the construction of certain parts of the apparatus *must remain* SECRET.

By the side of the key board, there is placed a small galvanic battery, from which proceeds the wire, 25 yards in length, passing round the room. Along this wire the shock is passed, and operates upon that part of the apparatus which discloses the letters or signal. The shock is distributed as follows: The underside of the signal keys are each furnished with a small projecting piece of wire, which, on depressing the keys, is made to enter a small vessel, filled with mercury, placed under the outer ends of the row of keys; a shock is instantly communicated along the wire, and a letter, or signal, is as instantly disclosed in the oblong box. By attentively looking at the effect produced, it appeared as if a dark slide were withdrawn, thereby disclosing the illuminated letter. A slight vibration of the (apparent) slide, occasionally obscuring the letter, indicated a great delicacy of action in this part of the contrivance, and although not distinctly pointed out by the inventor, is to be accounted for in the following manner: when the two ends of the wire of the galvanic apparatus are brought together, over a compass needle, the position of the needle is immediately turned, at right angles, to its former position; and again, if the needle is placed with the north point southward, and the ends of the wire again brought over it, the needle is again forced round to a position at right angles to its original one. Thus, it would appear, that the slide or cover over the letters, is poised similarly to the common needle, and that by the depression of the keys, a shock is given in such a way as to cause a motion from right to left, and *vice versa*, disclosing those letters, immediately, under the needle so operated upon."—*London Mech. Mag. Vol.* xxviii., 1837.

Masson Magneto-Electric Telegraph.

In 1837, Prof. Masson, of Caen, addressed a letter to the French Academy, in which he announced that he had made several trials with a magneto-electric telegraph, for the distance of 1800 feet. He employed for the development of the current, the magneto-electric machine of Pixü, to produce the deflexion of magnetic needles placed at the extremities of the circuits. These trials were repeated in October, 1838, with Bréquet, who was at that time one of the members of the Commission on the Telegraph from Paris to Rouen, but the results obtained were not as satisfactory as those of Steinheil, Morse, and others; afterwards Mas-

son and Bréquet associated themselves together, and invented a new form of telegraph, a description of which is not given.—*Moigno Traité de Telegraphie, p.* 30.

Amyot's Telegraph.

In a letter addressed to the Academy of Science of Paris, in July, 1838, Amyot proposed the construction of a needle telegraph. It was to consist of a single circuit, which would move a single needle, which needle was to write on paper, with mathematical precision; the correspondence which was to be transmitted to the other extremity, by a simple wheel, on which it should be written by means of points differently spaced, the same as they are on the barrels of portable organs, the wheels to be regulated by clock work.—*Moigno, p.* 31.

To be Continued.

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*Experiments on Cement at the Great Exhibition.**

Some interesting and important experiments on the strength of cements, &c., were made on the 20th, 22d, and 23d inst., at the Great Exhibition, under the supervision of the jury of Class XXVII., when the large beam of hollow bricks and Portland cement, erected in the area at the west end of the building by Messrs. J. B. White & Sons, of Millbank, was broken down. The experiments were watched with great interest by a large number of scientific men and others. Confining ourselves for the present to the works of the firm we have named, we will record some of the experiments which preceded the attack on the beam. The weights used were iron pigs, averaging 100 lbs. each.

The first experiment was on a block of neat Portland cement 4 inches square, suspended at each end, and 16 inches long between the bearings. The weight was applied exactly in the centre. This was broken down by 1580 lbs., including the weight of the scale: the fracture was perpendicular. The block was four months old.

2. A block of neat Roman cement (Harwich stone), exactly the same size as the last, seven months old, broke down with 380 lbs. This must have been defective, and we may say, as applying throughout, that single experiments on the strength of materials must never be trusted to for general deductions, the most extraordinary variations being often found in specimens prepared under, what may be considered, precisely the same circumstances.

3. A block of neat Sheppy cement, the same size as the last, broke with 980 lbs. in the scale.

4. A block of neat Portland cement, six months old, 2 inches thick, and $2\frac{3}{4}$ inches wide, required 2280 lbs. to pull it asunder.

5. Two pieces of Portland stone, 6 inches square (each 6 inches high too,) cemented together by a thin joint of neat Portland cement (four months old,) were suspended. When 3700 lbs. were in the scale attached to the lower stone, the top stone yielded where the iron clippers held it. Afterwards the square holes for the ends of the clippers were made deeper in another part of the stone, and 4500 lbs. were put into the scale, when the iron hook broke, the joint remaining sound.

*From the London Builder, No. 451.

The materials here use being Portland *stone* and Portland cement, it was with difficulty that some of the foreigners present could be made to understand that the latter was not made from the former, and we mention the circumstance as an illustration of the erroneous impressions given by improper appellations. It is the same with Roman cement. A scientific French writer in describing that marvellous piece of construction, the Thames Tunnel, deceived by the name, says that the engineer succeeded here by adopting *the cement of the ancient Romans*, although, as we know very well, the cement in question which really was used had no more to do with the Romans than it had with the Pope.

6. Two pieces of Portland stone, the same size as the last, joined together with Roman cement, five months ago (a thicker joint, by the way, than in the previous case,) required 2780 lbs. (including scale) to separate them,—a much greater weight than was anticipated. The cement left the stone; so that its adhesive power yielded, not its cohesive.

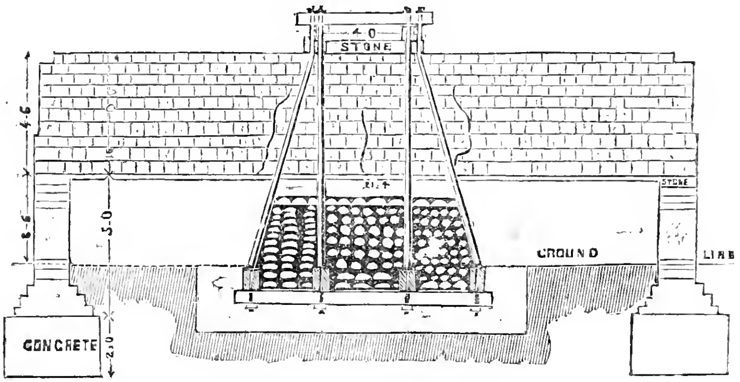
Turning now to the principal example of the series—the hollow brick beam—we annex views of the front and end of it, showing its dimensions and construction, and the mode of applying the weight.

During Saturday the beam was loaded in the central part with 15,000 lbs. weight of pig iron, and in this state it was left until one o'clock on Monday, when it was carefully examined and found quite free from any indication of failure. The loading was then resumed until it was weighted with 40,000 lbs., at which time a deflexion of nearly one-eighth of an inch was observed: with 41,600 lbs. two cracks exhibited themselves in the four lower courses, at a short distance right and left of the centre of the beam, and a crack in the centre of the beam. With 51,600 the cracks extended through the six lower courses and the deflexion increased to five-sixteenths of an inch; with 62,800 lbs., which it bore for a short time, the beam gradually separated into two parts as nearly equal as possible, the line of fracture being vertical and indiscriminately through bricks and joints as they occurred. In falling, the beam thrust the piers considerably out of an upright.

It will be remembered by many that in 1837 an experimental brick beam was (at the suggestion of Mr. Brunel) built by Messrs. Francis and White, at their cement works, Nine Elms, Vauxhall, for the purpose of ascertaining the strength of Roman cement. The beam consisted of hard stock bricks, bonded in the usual way, and bedded and grouted with a mixture in equal portions of the best Roman cement and clean Thames sand, making it completely hollow throughout. It consisted of nineteen courses of bricks, the thirteen uppermost courses being two bricks or 18 inches in thickness, and the six lower courses two-and-a-half bricks, or 1 foot $10\frac{1}{2}$ inches in thickness. The sectional area was, therefore, thirteen courses, at 3 inches each, $=39$ inches $\times$ 18 inches thickness $=702$ inches; six courses, at 3 inches each, $=18$ inches $\times$ $22\frac{1}{2}$ inches thickness $=405$ inches, total sectional area 1107 superficial inches, and in the lower courses were inserted (as we understand) fifteen lengths of hoop-iron, $1\frac{1}{2}$ inch and $\frac{1}{16}$ inch.* The beam was supported at each end, leaving a clear bearing of 21 feet 4 inches, and after it had been built about *three months* it was loaded with 11,200 lbs. of pig-iron, placed on

* General Pasley says, in his work "On Limes," five only, p. 162.

a platform, which was suspended at the central part of the beam, which weight was increased at the end of another three months to 24,000 lbs. In this state it was left for twelve months, at the termination of which period it was determined to load it until it broke down, which was effected by increasing the weight to 50,622 lbs.



DIMENSIONS.

Neat length,	24 ft. 4 in.
" length,	21 ft. 4 in. in clear of piers.
" depth,	4 ft. 6 in.
" thickness,	2 ft. 4 in. bottom, and 1 ft. 6 in. upper part.

Built of equal parts cement and sand; completed, 12th April; centres struck, 22d April.

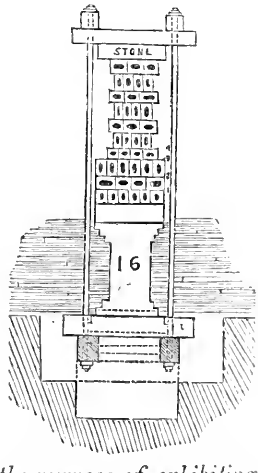
CONSUMED:

1200 hollow bricks, weight, 10,750 lbs.
32 bushels cement, } 6,400 "
32 ditto sand, }
———17,150

If built in common bricks would require—
2700 stock bricks, weight, 13,420
50 bushels cement (Roman,) } 8,000 21,420
50 ditto sand }
difference, 4,270

Weight of scale and iron work, 1,792 lbs
" of stone, 672 "
" of beam in suspension between piers. } 15,00
———17,464 lbs.

In common bricks:
Scale and stone, . . 2,464
Net weight of beam, . . 18,743 21,207 lbs.
difference, 3,743 lbs.
=1 ton, 13 cwt. 1 qr. 19 lbs.



Messrs. White and sons had determined, *for the purpose of exhibiting the strength of Portland cement as compared with Roman cement*, to erect a brick beam in all respects similar to the last described (except the substitution of *Portland* for *Roman* cement;) but a short time previously to the opening of the Exhibition, it was suggested to them that if they made

use of hollow bricks instead of the ordinary solid bricks, it would add much to the interest of the experiment (as experiments upon hollow bricks were much wanted;) and in compliance with this suggestion, they erected, a few days before the opening of the exhibition, *a beam of hollow or tubular bricks, with Portland cement and sand (in equal portions,)* with iron hooping in the lower courses, and generally following, in all respects, the dimensions and form of the beam built with Roman cement at Nine Elms, as far as the use of the hollow bricks would permit. The weight was applied in the central part of a clear bearing of 21 feet 4 inches, in the same manner as to the Roman cement beam. The use of the hollow bricks occasioned some difference in the sectional area, which we have to take into account; but we shall disregard in the present comparison the disadvantages arising from having merely the narrow edges of the tubes to connect with the cement instead of the broad surfaces of ordinary bricks.

The Portland cement beam, as will be seen by the accompanying diagrams, consisted of ten courses; the upper part having three courses on edge, and four flatwise, and the lower part two courses on edge, and one flatwise. The bricks were all laid as stretchers, and the beam consequently consisted of a series of forty tubes (the number of bricks in section throughout,) which were open from end to end of the beam. The average size of the bricks was $5\frac{5}{8}$ inches by $4\frac{1}{8}$ inches, and, the rims or sides being about $\frac{7}{8}$ of an inch in thickness, the tubular or hollow parts were each equal to 9 inches super. But with the joints and beds the whole measured in the six upper courses an average of 36 inches $\times$ 17·52 inches, $=$ 621 inches; and in the three lower courses an average of 1.05 $\times$ 26·6 inches, $=$ 439 inches; making a total area of 1060 inches: from this deducting the forty vacuities, or hollow parts, of 9 inches each, $=$ 636 inches, we have as the net sectional area, 700 inches.

By an inspection of the diagram, it will be seen that as the vacuities are distributed throughout the whole depth of the beam, they occasion a loss of strength nearly proportionate to their whole extent, varying of course as their distances from the neutral axis.

On the part of Messrs. White it is argued that the depth of the Roman cement beam being 57 inches, and the sectional area 1107 inches; and the depth of the Portland beam being $52\frac{1}{2}$ inches, and its net area, 700 inches, we shall have $1107 \times 57 = 63{,}099$; and $700 \times 52\frac{1}{2} = 36{,}750$, as expressions of the relative strength of the two beams, supposing they had been built of the same materials.

The *Roman* cement beam (as before mentioned) was broken down with 50,652 lbs., and since 63,099 : 36,750 : : 50,652 : 29,500, it follows that if the *Portland* cement beam had broken down with 29,500 lbs., the two cements would have exhibited equal strength; but, inasmuch as it took 62,800 lbs. to break down the *Portland* cement beam, the experiment exhibited a superiority of *Portland* cement over *Roman* cement in the ratio of 2·128 to 1, or, in round numbers, $2\frac{1}{8}$ to 1. This reasoning, however, is scarcely correct, since it does not take sufficiently into consideration the strength dependent on *disposition* of the material.

From some experiments made upon Portland and Roman cement, where solid bricks were used with each, the superiority of Portland cement

was found to be much greater than this is shewn by experiment,—but when we consider the nature of the structure, and take into account the circumstance of the *Roman* cement beam having been built *seventeen months* before the breaking weight was applied, whereas the *Portland* cement beam had been only erected *five months*, we are not surprised that the experiment with the hollow bricks did not exhibit the full strength of Portland cement. It is to be regretted that hollow bricks were used, as it would have been better to have rested the comparison upon two beams as strictly analogous as possible, instead of complicating the subject with conditions that are extraneous to the immediate inquiry.*

The important part played by the iron bond in this experiment must not be overlooked. Sir Charles Pasley, in his work on cements, describes two beams constructed by him for the purpose of ascertaining, how much of the extraordinary resistance of brick beams built with cement might be owing to the hoop iron bond. These were precisely similar, with the exception that one of them had five pieces of hoop iron bond, and the other none. The latter cracked when the centering was removed, and was broken by a weight of 498 lbs., while the first sustained a weight of 4523 lbs. before it yielded. "The mutual adhesion of the cement and the iron, says that author, is so perfect, that no force can separate them without producing the complete fracture of the brickwork, which is thus resisted by all the tenacity of the iron."

The tensile strength of wrought iron per square inch of section, may be called 27 tons. The mean of Mr. Telford's experiments gave 29 tons, as did some conducted under our own superintendence. Mr. G. Rennie says 24·93, and Capt. Brown 25 tons.†

In the hollow-brick beam there were fifteen pieces of hoop iron bond, one and a-half inch by one-sixteenth of an inch, nearly; namely: four in the first course, four in the second, three in the third, and two in each of the next.‡ The pieces of iron were all broken, except one in the bottom course, one in the second, and one in the top course.

This very interesting proceeding suggests many observations, but we must now pass on to the experiments, also on Portland cement, which were exhibited on the same occasion by Messrs. Robins and Aspdin, of Scotlandyard.

1. A suspended block of cement, $3\frac{7}{8}$ inches wide, and $2\frac{1}{8}$ inches thick (one month old,) was pulled asunder by 3240 lbs., including the weight of the scale.

2. Sixteen stock-bricks, attached to each other with neat cement, supported at one end, and projecting from the bearing point 3 feet $2\frac{1}{2}$ inches, broke in the eleventh brick with 256 lbs., exclusive of scale, suspended on the extreme end.

3. A solid step, 6 feet 5 inches long, and $7\frac{1}{4}$ inches deep at the back, formed of two parts Portland cement and one part broken bricks, held up at one end, carried itself, and broke off close to the bearing-point when the third 56 lbs. weight (168 lbs.) was placed on the extreme end. The weight of the step was called $4\frac{1}{2}$ cwt.

* Hollow bricks are usually better moulded and more thoroughly burnt than ordinary stocks.

† Eight or nine tons may be considered a safe load-strength.

‡ In the diagram, by mistake, only fourteen are shown.

4. Two blocks of neat cement, 1 foot $5\frac{1}{2}$ inches long, 9 inches wide, $4\frac{1}{2}$ thick, cemented together with neat cement, bore 6000 lbs., when the lower part of the lower block gave way.

5. Twenty stock-bricks, united side by side with cement, composed of one of cement and one of sand, 3 feet $6\frac{1}{2}$ inches in bearing, were supported at each end by iron clamps; the weights being applied to the centre, the bricks broke with 1200 lbs.

6. Six fire-bricks, in courses, cemented together with pure cement, were suspended, and weights were applied to pull them apart; the upper brick broke with 2836 lbs. in the scale.

7. The five fire-bricks from the last trial were again tested, iron being inserted in the second brick from each end; the upper brick broke, carrying away also part of the lower, with weight of 4600 lbs.

8. Two pieces of Portland stone, 2 feet by $11\frac{1}{2}$ inches, $7\frac{3}{4}$ inches thick, cemented together with neat cement, took a weight of 7272 lbs.; when the lower stone yielded, carrying away a small portion of the cement joint.

Our readers will find other experiments on the same material, both by Messrs. White & Sons, and Messrs. Robins and Aspdin, in our sixth volume, pp. 343, 351, and 471.

For the Journal of the Franklin Institute.

Note on the Tow Boat "America," and her Trial Trip.

A new steam tug, under the above name, has recently been placed upon the Delaware river, by the "Philadelphia Steam Pump and Towing Company," and was tried Dec. 8th, 1851. Her dimensions are, length (between perpendiculars) 133 feet; extreme breadth, 25 feet; depth of hold, 13 feet. She is rigged with two masts, with fore and aft sails to be used in case of accident to her machinery; and is propelled by two vertical direct action trunk engines, with cylinders, having each an effective area equal to 32 inches diameter, and 30 inches stroke, attached to a propeller (true screw) 10 feet in diameter, 26 feet pitch; angle of blades at periphery with a line perpendicular to the axis, 39° 30′; total absolute surface of blades, 61·30 square feet. She has one boiler, of the description known as the Horizontal Return Tubular, having large flues below and tubes above. The fire room is forward.

Her performance on the trial was as follows:

From Navy Yard shears to Chester wharf, 1 h. 53 m. 23 sec., against flood tide; average pressure of steam in boilers, $26\frac{1}{4}$ pounds; at steam chests, $25\frac{1}{4}$; average vacuum, 26 inches; revolutions made, 5501; average per minute, 48·5; distance, 16·25 miles; speed per hour, 8·6 miles. During this part of the trip, the "thrust" journal of the propeller shaft gave trouble by heating, reducing the number of revolutions. On the up trip, time from Chester wharf to Navy Yard shears, 1 h. 14 m. 57 sec; steam and vacuum about the same as before. Revolutions made, 3822, or 50·95 per minute. Average speed, 13 miles per hour; tide, flood, as before, and therefore in favor. To find the slip, the velocity of tide must be ascertained

as follows: had the journals not heated going down, 50·95 revolutions would have been made, increasing the speed to 9·04 miles per hour.

Speed coming up was, . .	13	"
Difference	3·96	
Or, average speed of tide per hour,	1·98 miles.	

This speed, therefore, on the down trip, acting for 1 h. $53\frac{1}{3}$ m. increased the distance run by . . . . miles 3·740
On the up trip, acting 1 h. 15 m., diminished the distance run by 2·475

Whole increase of distance,	1·265
Distance performed (by shore marks,) . .	32·500
Space absolutely passed over, miles	33·765

$$\text{Then } \frac{33{\cdot}765 \times 5280}{93223 \times 26} = \frac{178280 \text{ feet}}{242408} = 73{\cdot}54$$

and 100—73·54 = 26·46 per cent. mean slip of the propeller. The vessel was drawing 12 feet aft, and 9 feet forward, at the time of the trial.

The performance of the engines was very good, and their workmanship and appearance highly creditable to the makers, James T. Sutton & Co.; the hull was constructed by Vaughn & Lynn.

Note.—On the above trial the brass packing around the trunks became constantly very dry and required great attention. This brass packing has since been replaced by hemp, and (it is stated,) the change has resulted in a gain of 4 to 5 more revolutions over the number obtained on the trial. M.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, December 18, 1851.

S. V. Merrick, President, in the chair.

John F. Frazer, Treasurer.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

A Letter was read from Mrs. E. Taylor, informing the Institute that the Collections of Minerals, Scientific Books, and Instruments of her late husband, R. C. Taylor, Esquire, will be held at private sale at No. 48, South Fourth street.

Donations were received from The Royal Astronomical Society, London; The Baltimore and Ohio Railroad Company, Baltimore, Md.; The Chicago Mechanics' Institute, Illinois; The Hon. T. M. Bibighaus and Joseph R. Chandler, Members of Congress; and H. Carey Baird, Charles E. Smith, and Isaac Lea, Esq.'s, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statement of the receipts and payments for the month of November was read.

The Board of Managers and Standing Committees reported their minutes.

The Special Committee appointed at the last meeting, respecting the publication by Messrs. Yerger & Ord, of the Report of the Committee of Judges on Surgical Instruments at the late Exhibition, presented and read their report, in which they recommended the following resolution, which was on motion adopted:

Resolved, That the Actuary be directed to announce through the public papers, that no action has been had by the Committee on Exhibitions nor by the Institute, on so much of the report of the Judges on Surgical Instruments, at the late Exhibition, as relates to Artificial Legs and Club Foot Apparatus; and that the publication thereof made by Messrs. Yerger & Ord, is without authority or consent of the Institute, or the Committee on Exhibitions.

Resignations of membership in the Institute (5) were read and accepted.

New candidates for membership in the Institute (21) were proposed, and the candidates (97) proposed at the last meeting were duly elected.

Nominations were made for Officers, Managers, and Auditors of the Institute for the ensuing year.

On motion, it was resolved that the election for Officers, Managers, and Auditors of the Institute for the ensuing year, be held on Thursday, January 15th next, between the hours of 2 and 8 o'clock, P. M., and that seven members be appointed to conduct the election.

Dr. Rand exhibited to the members a new gas burner, which possesses the advantage of great steadiness of light, being the only one yet found sufficiently steady for microscopic purposes, and comparing in this respect with the Carcel lamp. It is a modification of the burner known as the "patent burner," and is the contrivance of Dr. P. B. Goddard, of this city, well known for his accuracy as a microscopist. It consists of the patent burner of the medium size, having the button attached to the central tongue sawn off at the level of the holes, for the admission of the gas, and the outer row of holes for the admission of air stopped up, a cylindrical chimney being used. He also presented one having the outer row of holes left open, which was found on trial to give an equally steady light. Dr. Rand mentioned that he had, with Mr. G. W. Smith and Dr. C. M. Cresson, ascertained the economic value of this burner, by Ritchie's photometer, and gave the result as follows: The two burners were compared with a fish-tail burning 5·7 cubic feet per hour. Its value, as calculated and compared with a standard candle, was 14, that of Dr. Goddard's burner 9·1, and that of the second form of burner 10·4. Thus showing that, as far as the experiments went, the steadiness of the light is at the expense of economy, a result he believed accordant with the general rule in regard to all gas burners. He further remarked, that as the fish-tail was a large one, the result might appear rather too marked against the modified burners, inasmuch as he believed it to be true that the relative economy of bat-wing or fish-tail burners increases in a rapid ratio with their size. The experiments with these and other new burners will be further prosecuted.

Prof. Frazer said he believed that not only did candles of the same size and material burn unequally, but that the same candle burns with different rapidity and amount of light at different times. He had found in his class experiments, that two similar candles lighted at the same time would alternately burn above or below an average line.

Prof. J. C. Cresson, in reply to inquiries, remarked in relation to the standard candle, although it might be true that all spermaceti candles six to the pound did not burn equably, yet it had been convenient to assume that size as a standard. It was also true, that as we reached the maximum of economy in a burner, we rendered the flame more liable to be influenced by slight changes in the supply of air or gas, and thus unsteady. He explained the greater relative economy of large bat-wing and fish-tail burners by the fact, that as the size increases the sheet of gas becomes thicker, and less gas is burned before decomposition.

Prof. Frazer stated that he had found the double cut burner advantageous, as it gave a good, strong light when burned comparatively low, and an economical light at the full head of the gas. He further remarked that this double cut burner was not new, as had recently been claimed.

Dr. Rand further exhibited some oil of resin, distilled by the Pennsylvania Oil Company, at Port Richmond. This Company recently commenced the manufacture of oils from resin, under the patent of Louis S. Robbins, issued November 4, 1851, and they are now manufacturing machinery, paint, and tanner's oil. These are made by the same process as those of the New York Company at Brooklyn. The specimen presented was intended as a lubricating oil, and is represented by the manufacturers to possess decided advantages over any other oil now in use for this purpose. It is also represented as not liable to congeal, or to inflame with cotton.

Mr. G. W. Smith drew the attention of the meeting to the subaqueous method of removing rocks at Hell-gate and other places in the harbor of New York, under the direction of M. Maillefert, by the direct application of canisters of powder to the surface of the rock, without the intervention of drilled holes, although the latter had in a few instances been resorted to. Mr. S. alluded to the previous efforts in subaqueous blasting, made in Europe and elsewhere, and described the great waste of force in the method of M. Maillefert, stating that the whole force expended in elevating the water to a vast height in the air was wasted, and that the method never should be resorted to where drilling was at all practicable, and deprecated the proposed introduction of a method, moreover not new in itself, to the blasting of rocks in the Delaware and Schuylkill rivers.

Mr. G. W. Smith presented the statistics of all the Coal mined in the State of Pennsylvania, both bituminous and anthracite, including not only the amount sent to market, but also the local consumption by families, by manufacturing establishments in the coal regions, &c. The amount of anthracite is nearly 4,900,000 tons for the present year, 1851, and of bituminous nearly 2,400,000 tons. The data as to the latter he stated would require some revision, and the total statement of the amount will appear in a subsequent number of the Journal. Mr. S. begged the meeting to consider that the *production* of coal in Pennsylvania was nearly three tons for every man, woman, and child of the whole population of

the State; while in the British Islands the production was only about one ton for each inhabitant. The domestic consumption and exportation being included in both cases, the consumption, however, per individual is of course much greater in Great Britain, where they are wholly dependent on this fuel, as is well known.

BIBLIOGRAPHICAL NOTICE.

Appletons' Dictionary of Machines, Mechanics, Engine Work, &c.

In the December number of *Appletons' Magazine* there is a reply to our comments upon the omission of Mr. Byrne's name from the title pages of the Encyclopedia which he wrote for the Messrs. Appleton. The following is the substance of the article:—

In the month of June, 1850, we were invited by the Messrs. Appleton to take the entire charge of the editorial department of their great Dictionary, then in progress, and published as far as the letter F. Mr. Byrne (whom we have never met) ceased to have any control over the work after this date, and we commenced our editorial duties with the letter G, and after sixteen months labor brought it to completion.

That our own name did not appear on the covers of the work as it issued from the press was entirely owing to the circumstance that as the Dictionary had then a large circulation, and known as Byrne's Dictionary of Machines, &c., the publishers, for obvious reasons, did not think they were called upon to publish the fact of a change in the editorial department, but finally withdrew Mr. Byrne's name from the cover of the numbers; and at *our own* instance substituted their own in its place. There being a manifest impropriety in issuing to the public, as edited by a gentleman, a volume with which he had no connexion, will sufficiently account for Mr. Byrne's name not being inserted in the *Second* volume, however he might have been entitled to that consideration in the First. *We* were not ambitious of having edited *half* a book—hence, declined the honor of appearing on the vacated title page of this same volume; and if the Messrs. Appleton saw fit to publish their Dictionary without acknowledging the editorial labor expended upon it, no one should complain so long as *we* were content.

We have received a note from Mr. Byrne, containing the following assertions: "I am the compiler and editor of the Dictionary of Machines, &c., &c., from A to Z." "I selected, superintended, *wrote* and collected, collated, compared, examined, and prepared the work for publication." Mr. B. also submitted to our inspection copies of his agreements with the Messrs. A., in which he is spoken of both as the editor and the author; also a copy of a subsequent memorandum, dated May, 1850, in which some especial arrangements as to payments, &c., are agreed on. Now our proposition is simply this,—If Mr. Byrne did write and compile the entire work he was entitled to the credit of it, and it was wrong to take his name off the title page. If Mr. Byrne did, as he alleges, prepare the whole work for publication, his case is still stronger. But there is another point to which we would call the attention of the editor of *Appletons' Magazine*. If "the manifest impropriety in issuing to the public, as edited by a gentleman, a volume with which he had no connexion, will sufficiently account for Mr. Byrne's name not being inserted in the second volume," how comes it that the original title page of the second volume has his name on it, and was afterwards cancelled, and the one without it substituted? F.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

FEBRUARY, 1852.

CIVIL ENGINEERING.

*Extract from the Report of the General Board of Health respecting the Metropolis.—Water Supply and Drainage of Towns.**

Continued from page 6.

Professor Way was asked: "For the collection of the rain-fall of a given district, what soil would you prefer?" "I should say, decidedly, a sand. Rain-water, when collected at a distance from towns, is fit for every purpose. All that is required from the collecting surface in this case is, that it shall perform its office without imparting to the water anything to render it impure. Sands which have been washed by rain for ages are most likely to fulfil this condition, and would possess the further advantage of allowing the ready escape and collection of the water."

Specimens of surface-water collected at various points in districts surrounding London were examined; amongst these was a specimen from the Ruislip Reservoir, the water from which is used for feeding the Grand Junction Canal; this water is from the surface-drainage of a tract of clay land, and "gives 8 degrees of hardness, or just one-half the impurity from lime of all the rest of the Company's specimens put together."

The searches made south-west of the metropolis appear, however, from the nature of the strata, to be attended with the greatest promise of success. The evidence of Mr. Donaldson is given at length respecting Richmond Park as a gathering-ground, as "this one plot of land is illustrative of the principle of improved supplies." The soil of that park "is a sandy or gravelly loam, incumbent on a clay subsoil." The water drained from it was "perfectly clear, soft to the feeling, well aërated, and pleasant to

* From the London Mechanic's Magazine, for September, 1851.

drink." Mr. Donaldson said, in his evidence, "I am, from long observation, aware that water passing through a bed of vegetation does leave behind, not only the matter in mechanical suspension, but much of the matter in chemical solution. This is a point which has not hitherto received the attention which its importance deserves. I am quite sure that a bed of vegetation will detain for its food saline and other matter in solution, which no sand or other artificial filter will separate from the water. I have seen water containing a considerable quantity of sewage from a farm-yard, which has passed upon well-drained pasture land, and the water which has drained through it, has come out perfectly clear from the manure in solution."

"It is to be presumed, however, that there might be an extent of manuring, or shallowness of the filter bed of earth, which would *not* detain the matter in solution? No doubt of it." Animalculæ have never been met with by Mr. Donaldson in shallow spring-water as it came from the spring or drain.

The ordinary rain-fall at Richmond Park is estimated at 25 inches; the usual calculation of the quantity of water collected from rain-fall is the third of the amount of fall.

The Board has in review various sites in the vicinity of the metropolis which might be applicable as gathering-grounds, but give a preference to the tract "commencingwith Bagshot and Woking sands, and extending to Hampshire." Farnham has been for some time supplied with soft water by the drainage of less than two acres of the common land. The water "is delivered clear and limpid at all times of the year." "There is no reason why the same quantity of water should not be obtained from the whole of a tract of waste land there, ten miles long and five broad." "The improvement of most of these tracts has hitherto been given up in despair, and the growth of fir is recommended as the only agricultural purpose for which they are fitted." The Bagshot sands are estimated as covering an area of 300 square miles. "Beneath these sands is a retentive stratum of marl and clay, varying from five to fifteen or twenty feet in thickness."

"The portion of this district to which our attention has been more immediately directed, comprises an area of no less than 100 square miles, lying east and west of a line from Bagshot to Farnham." "Waters collected in this district at the surface, immediately after rain-fall, are of the highest degree of purity, being in large quantities not exceeding one degree of hardness."

"The chief practical result deducible from these observations is, that by arrangements for collecting the water before it has traversed any great extent of surface, a quantity sufficient, as it appears, for the domestic supply of the whole metropolis will be obtainable at a very high degree of purity, probably equal to the present supply of Farnham."

"The nature of the source requires a preservation of the rain during periods of its maximum fall, for a regulation of the supply during periods of a minimum fall. The storage-room must therefore be very extensive. The primary engineering disadvantages of this district are, that it presents no deep natural hollows, such as are available to many of the northern towns, for the storage of water without extensive excavations. Here the excavations for storage reservoirs must be very large and extensive.

Against the modern engineering practice of exposed and open reservoirs, we would rather revert to the custom of the Roman engineers, and recommend covering the service reservoirs and aqueducts to the utmost extent practicable."

"As a foundation for proximate estimates, plans have been got out by our engineering inspectors for extensive covered reservoirs, and for the conveyance of the water in deep conduits, also covered. They estimate the total expense of storing and bringing to the metropolis this new and improved supply, inclusive of reasonable compensation for waste land for reservoirs, at little more than one million sterling. We fully believe that two years' saving from the use of the purer water, would fully repay this portion of the outlay."

The Board evidently give a preference to the obtainment of water from suitable gathering-grounds, which, on account of its softness and purity, they consider as superior to that from the sources of supply indicated by Captain Veitch. This gentleman's evidence is, however, given at length in Appendix, No. 2. It appears by that evidence that he indicated several different available sources of supply, and he recommended them on account of their perennial abundance, "considering that the population of the metropolis has nearly doubled itself in 45 years," "and that great solicitude is entertained lest the same rate of increase may continue to 1890, I consider it a most important measure to secure all the best supplies of water that can be obtained near London, before they be appropriated to other objects of minor importance." The sources particularly adverted to are as follows: those at Hertford, where "there is a singular meeting of four copious streams of water proceeding from chalk valleys, viz: the Lea, the Verulam, the Beane, and the Rib, which jointly have a discharge of 9,360,000 cubic feet per diem;" "the Ash, the Stort, and springs which join the river Lea below Ware, about 4320 cubic feet of water per day. Such are the resources of the river Lea and its tributaries, and which for the paramount object of supplying the increasing population of the metropolis with so needful an element of health and consumption ought to be held sacred for that purpose alone." The conjoint waters of the river Lea, at Field's Weir, "amount to fourteen millions and a half of cubic feet, or ninety-four and a quarter millions of gallons per day." In respect to other sources, Captain Veitch said, "I conceive, in the first place, that the water of the river Verulam is the first to be secured, and rendered available for the public good at London; the water of this river taken a little above Watford, is a never-failing stream, derived from springs, and yielding three millions of cubic feet of water per diem, at an altitude of 158 feet above high water in the Thames." "Similar to the supplies of water on the north-east of London, which unite to constitute the river Lea, those on the north-west of London unite to constitute the river Colne, and consist of the following streams: The Colne proper, an insignificant brook in dry weather:" The "Verulam, a fine stream," is chiefly fed from springs, and is clear and constant, with an average yield of about 3,000,000 cubic feet per diem: The Gade, chiefly fed by springs, yields a supply of about 4,000,000 cubic feet per diem: The Chess, a lime stream fed by springs, 2,000,000 feet per diem. The above streams

have their water united a little way above Rickmansworth." The river Mole is only noticed as a probable source that may be available.

For the supply of water to the south side of the Thames, Captain Veitch had "especially directed his attention to the waters of the river Darenth," which yield about 2,600,000 cubic feet per diem." "The waters above specified," may all be delivered to reservoirs, 140 feet above high water mark. Captain Veitch was asked, "Do you not consider the above quantity of water as unnecessarily great? If water can be brought to London from such short distances, and at such an altitude on the gravitation system alone, cool and clear in quality, I do not consider that any quantity of such water, and under such conditions, can be deemed over abundant for the health of the population." The supply of water to Rome, under the Empire, "by the Roman aqueducts, amounted to about 50,000,000 cubic feet per day, for the use of a population presumed to have consisted of about 1,000,000." The population of London is now about two millions and a quarter; Captain Veitch conceives that forty years hence it may be increased to 4,000,000 of souls.

A statement of *all* the schemes that have been proposed for the supply of water to the metropolis has been drawn up by Mr. Henry Austin, and is published in the Appendix, No. 2, of the Board's Report; but as they are all of them variations only of the principal schemes, following up the Board's recommendation of gathering grounds, or deep wells, or Captain Veitch's, to take advantage of existing springs and streams, it seems superfluous in this abstract to enter into particulars of these minor schemes.

As to deep wells, it is abundantly proved that they could not afford a sufficient supply. Whether to prefer the collecting of water from gathering grounds, preserving it pure in covered reservoirs, or whether the bringing water impregnated with lime from streams affording a perennial supply, and providing for the purification from lime of the water before delivery, seems mainly a question of pounds, shillings, and pence. The greatest expense attendant on the former mode seems to arise from the immensity of reservoir required—that reservoir necessarily a *covered* one; for it is admitted, that in an *open* reservoir the water would become even more contaminated with organic impurities, animal and vegetable, than it is found to be even in the Thames. These reservoirs would have to provide not only for a sufficient supply during the dry weather of ordinary summers, but also for seasons of extraordinary drought; the leaving London so much as a single day without water, is too horrible a chance to be risked. There are some seasons when, for perhaps two months, there is no material rain-fall. How many acres of covered reservoir would suffice for the supply of London during such a drought? It is easy of calculation; so is the expense of depriving water of lime, which would be to be compared with the cost of covered reservoirs. The depriving water of carbonate of lime, by Professor Clark's process, might perhaps suffice—further purifying it in Mr. Holland's mode would add to the expense; but even that is compensated for, according to his evidence, by enabling thus the water to save soap in washing, and to require less tea, &c., in making extracts.

Should the gathering ground system be adopted, Professor Way's experiments, in addition to experience at Farnham, and to general agricul-

tural and other observations, indicate that the gathering grounds should be under the complete control of whatever person or persons may have to govern the supply of water to London; this would be essential, since those grounds should at all times be kept at a certain degree of vegetable production; enough of that growth to assimilate the whole of whatever adventitious manure might fall upon the grounds, as also any moderate quantity that might be permitted for the purpose of profitable cultivation of the area chosen as a gathering ground.

The properties desirable in water itself having been thus exhibited, and the sources from which a supply may be obtained, the next consideration is that of the most efficient and most economical mode of bringing water to the metropolis, and of distributing it therein with the greatest convenience and at the smallest cost to the inhabitants.

The General Board of Health are of opinion, that "even if the same sources of supply as those taken for the New River were eligible, and if those works belonged to the public, they ought to be abandoned, and the Roman principle of covered channels reverted to, as Captain Veitch proposes."

Captain Veitch, in his evidence, gave many particulars, showing that the mode originally adopted for the conduction of the New River was defective, on account of its being an open canal, following all the sinuosities of the ground, as on a contour line; that it had an inclination of only three inches per mile, but that "within the present century great ingenuity and great expense have been applied by the New River Company to correct the evils of the rude and vicious mode of conduit first adopted." He observed, that "a great objection to the conveyance of water for domestic purposes, in an open earthen channel, is, that the water must have a very slow motion, not exceeding half a mile per hour, to prevent the current wearing the channel-bed, and bringing in turbid water; the slow motion is again attended with serious evils, depositions of silt and decayed vegetable matter take place, which require to be cleaned out from time to time; in the warm season, so long and broad a surface exposed to the atmosphere gets heated to a degree favorable to the production of vegetable and animal life of the lower forms, and also in giving rise to a considerable quantity of waste from evaporation; the high temperature of the water rather facilitates the decoction of leaves and other vegetable matters, which get blown into the New River, to the manifest injury of the water; but there are other pollutions of a worse character, to which all open canals are subject. It is true, the New River Company have five acres of settling-grounds at Clerkenwell,* and thirty-eight at Newington, for the deposit of solid matters." "Such are the objections to all open water conduits conducted in earthen channels, the deficiencies of which will, however, be still better appreciated by a contrast with the qualifications that may be obtained for the same water, if conveyed in

* Dead dogs and cats are strained off by a grating before the water enters the settling ground at the New River Head, but other impurities cannot be so separated. A panic has sometimes been occasioned by a report that the New River was poisoned, as it happened during the excitement occasioned by Lord George Gordon's riots; all the water was then for a short time red; this, on examination, was found to have arisen from a quantity of refuse madder, thrown in from a dye-house.

covered channels constructed of stone or brickwork, and conducted in straight lines, with an uniform and efficient descent, crossing valleys on embankments or arcades, and piercing hills, by tunnels or adits; for example, the water of the river Lea might be conducted to London in such a channel from Ware, at a distance of 20 miles, instead of forty, and with a speed of one mile per hour, instead of half a mile; that is, the transit would be accomplished in twenty hours instead of eighty."

Mr. Rawlinson, in giving an account of the Croton aqueduct, instanced it as serving both as a warning and an example. The aqueduct itself has cost upwards of 40,000*l*. a mile, exclusively of reservoirs; it is supported upon a solid foundation wall, 17 feet thick; the "true aqueduct or water-way is constructed with a brick lining upon a concrete foundation." The whole structure is banked up with earth on each side. "It would be difficult to devise a more expensive work." "Nevertheless, in several instances, it has been found necessary to line the water-way with iron."

Mr. Rawlinson is of opinion that "iron, wrought and cast, may be much more extensively employed in water-works than has hitherto been the practice." "Where it is not thought advisable to cross a valley or river by an inverted syphon-pipe, an elevated wrought iron tube aqueduct may be constructed, light, elegant, nay, even graceful in structure." "Telford set an example in his celebrated Pont-y-Cypoylte aqueduct, which is 126 feet in height, 1007 feet in length, and has a cast iron water-way as sound and perfect now as the day it was made."

Mr. Rawlinson himself, in 1846, proposed a plan to the Corporation of Liverpool to bring in a supply of water from the river Dee. "The several intermediate valleys would have been crossed by inverted syphons, or by means of elevated aqueducts of wrought iron." His proposal was submitted to Mr. Fairbairn, who in his report to the Chairman of the Liverpool Water-works Committee, October, 1846, said that "tubes 6 feet deep and 2 feet wide, with close tops, can be made of sufficient strength to carry 33 tons of water on 100 feet span." "The weight of 100 feet of such a tube will be about 12½ tons."

In respect to durability, "care must be taken to prevent oxidation, and in order to do this effectually, it will be necessary to make the top of the tubes, as all the other parts, perfectly water-tight, and the tube being always full of water, it will be a great security against corrosive action in the interior. On the outside the usual preservatives must be applied; with these precautions, the tube might last for an almost indefinite period of time."

"The effects of winter, or the change of temperature, will not be severely felt on a long and somewhat flexible tube. Internally the temperature will not vary considerably, as it never can be above 60°, and never lower than 32°."

Thus it seems that Mr. Fairbairn is in favor of iron tubes.

Mr. Rawlinson appears to advocate economy in public works. He said that "If modern science has taught us how to make a steam engine, it has not yet fully inculcated the necessity there is that rigid economy should be studied in all engineering works." He gives the aqueduct of Spoletto as an example of the small quantity of masonry that suffices for

piers. "The middle arch of that structure is 328 feet in clear height, supported on piers 10 feet 6 inches thick." The Pont du Gard, near Nismes, France, might also have been noticed for the small quantity of masonry in its piers; in this instance they have occasionally to resist the immense force with which the waters of the Gardon come down suddenly upon the piers after storms in the mountains, converting a shallow brook into an impetuous broad river.

The mode of execution the Board prefers is not indicated in their Report; but it is said that, from proximate plans and estimates, "got out by our engineering inspectors for extensive covered reservoirs, and for the conveyance of the water in deep conduits, also covered," they estimate the "total expense of storing and bringing to the metropolis this new and improved supply, inclusive of reasonable compensation for waste land for the reservoirs, at little more than one million sterling." The Board, in their twenty-fifth question to Mr. Stirrat, of Paisley, said—"We find at present we can cover a reservoir at about 1000*l*. an acre." Mr. Stirrat had previously observed that, "as to covering or roofing the *storage* reservoirs, that is altogether unnecessary, as nothing of the kind" (the growth of vegetation and production of animal life) "affects us in so *deep* water." So, in other evidence, it is intimated that where waters are *deep*, the evils in question do not exist. As to loss by evaporation in uncovered reservoirs, Mr. Stirrat said—"It is a great mistake to imagine that evaporation takes place to any extent, even in the height of summer, from the surface of a reservoir, where the water is of any considerable depth. The deposit of dew, I think, counterbalances it. I have one pond 10 feet deep, on which I made the experiment, and found, in the heat of summer, that in two months it did not go down one-sixteenth part of an inch; and there might have been a small escape to account for even that diminution."

Whether on *political* grounds the water-supply of London should be from one single source, or from many different sources, does not seem to have been adverted to by the Board itself, or by any of their witnesses; nor, though the water were derived all of it from one and the same source, whether it might not be expedient to convey it to town in two or more conduits, rather than by a single aqueduct. That an army of foreign invaders would easily find its way to London, and burn it, is not to be feared; but that attempts to so destroy it, should be made by its own populace, experience has proved, and that in furtherance of this scheme cutting off the water was designed. Had Lord George Gordon's riots lasted another day, the mains at the New River-head would, it was dreaded, have been cut off, though such troops as could be spared were ordered for the protection of those works. It should not be lost sight of that, in all metropolitan disturbances, a great portion of the rioters is made up of those whose object is plunder, and that plunder is facilitated by extensive conflagration. In that fearful night, when his Lordship's mob had the upper hand, no less than fourteen separate fires were counted from one house-top; and then it was that the abundant supply of water saved the town. Of late, too, when setting fire to houses was one of the projects in an intended insurrection, the water would doubtless have been cut off.

On such accounts, this political question in regard to water-supply seems well worth consideration; and it will be hereafter shown by what arrangements water might be conveyed to every part of the town, though all but a single conduit were destroyed. M. S. B.

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*Experiments on the Strength of Wrought or Rolled Iron Joists.**

Messrs. Fox and Barrett have just introduced rolled iron joists as a substitute for cast iron in the construction of their fire proof floors, designed with a view to bring the expense to the same as those of cast iron, and thus render fire proof construction with joists of *wrought iron* as inexpensive, according to their statement, as the ordinary timber floors.

On the 25th November, some experiments were made on joists of two sizes, at the Baths and Wash Houses which are now being erected for the parish of St. James, in Dufour's Place, Poland Street. The weight was applied through a lever. The following particulars have been furnished to us.

The smaller of the two joists was $5\frac{1}{2}$ inches deep, and $\frac{3}{8}$-in. thick, with flanch top and bottom, $1\frac{3}{4}$ inches wide.

Length of joists, ... 17 feet.
Width of bearing, ... 16 "
Weight per foot run, 10 3-5 lbs.

Load on Centre.	Deflexion.	Weight per sq. ft. of floor which the load is equivalent to.
12 cwt.	·65	112 lb. per foot.
15	·80	140 "
18	1·00	168† "
28	1·45	260‡ "

The larger joist was 7 inches deep, and $\frac{7}{16}$-in. thick, with flanch top and bottom, $2\frac{1}{4}$ inches wide.

Length of joist, ... 17 feet.
Width of bearing, ... 16 "
Weight per foot run, $16\frac{1}{3}$ lbs.

Load on Centre.	Deflexion.	Weight per sq. ft. of floor which the load is equivalent to.
12 cwt.	·42	112 lb. per foot.
28	·785	260 "
32	·90	300† "
40	1·10	370§ "

AMERICAN PATENTS.

List of American Patents which issued from December 9, 1851, to January 6, 1852, (inclusive,) with Exemplifications by Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

21. For an *Improved Revolving Reverberatory Furnace;* Ambrose S. Beadleston, Au Sable Forks, New York, December 9.

Claim.—"What I claim as my invention is, the rolling or revolving furnace revolving on friction wheels or rollers, or their equivalent, in combination with an ordinary fire, such as is used in reverberatory furnaces, the two being combined in such a manner that the

* From the London Builder, No. 460.

† Up to this point the elasticity of the metal was uninjured.

‡ Permanent set on removal of load, ·075. A load of 18 cwt. on the centre was left on 18 hours, but produced scarcely any perceptible difference.

§ Permanent set on removal of load, ·062.

products of combustion, heated gases, etc., from the grate, shall pass into the interior of said rolling or revolving furnace, substantially as herein described; said rolling or revolving furnace being applicable to any purpose for which ordinary reverberatory or wind furnaces are employed."

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22. For an *Improvement in Potato Diggers;* Daniel D. Bell, Wawarsing, New York, December 9.

Claim.—"What I claim as of my own invention is, the arrangement and combination of the cutting and digging cylinders with the riddles, in the manner herein set forth."

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23. For an *Improvement in the Construction of Sounding Boards for Musical Instruments;* Cornelius Bogart, Charlestown, Massachusetts, December 9.

Claim.—"What I claim as my invention is, the above described mode of constructing the sounding boards of stringed instruments, by combining or arranging together, any suitable number of pieces of wood, prepared as above, all in manner and for purpose as herein set forth."

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24. For an *Improvement in Carbonic Acid Gas Engine;* John C. fr. Salomon, Cincinnati, Ohio, December 9.

"The nature of my invention consists in a new and useful mode of application of liquified carbonic acid gas, as a thermo-mechanic motor."

Claim.—"I do not claim the invention of carbonic acid gas in its liquified or aeriform character, as a motive power; neither do I claim the use of the hydrostatic press for liquifying the gas, as these principles have long been known and commented upon by Sir Hy, Davy, Faraday, Brunel, and others: but what I claim as my invention is, 1st, a carbonic acid gas engine, in which said fluid passes, from a reservoir where it exists in a liquid state, through suitable valves into a heated cylinder; thence into a refrigerator, where it is cooled, and thence through pumps, where it is condensed by hydrostatic pressure, and forced back again to the reservoir before named; the said engine being constructed substantially as herein described.

"2d, The combination of crimped leather washers, a spiral spring, or springs, and oil, or any lubricant, for packing the piston rods or plungers, as described."

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25. For an *Improvement in Gas Regulators;* Jotham S. Conant, Lowell, Massachusetts, December 9.

"The nature of my invention consists in interposing between the gas pipe from the gas works, and the main gas pipe in a dwelling, or other building, where gas is consumed, a small gasometer combined with a regulating valve, in such a manner, that the pressure of the gas in the pipe within said dwelling or other building, can be adjusted to any degree of pressure, and will remain at precisely the same amount of pressure, whether a large or a small number of burners be supplied by the said pipe."

Claim.—"What I claim as my invention is, the closing of the valve when the fluid becomes too low in the gas regulator, for safety, by the movement of the float and the lever, and their action upon the thimble on the valve rod, substantially as herein set forth."

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26. For *Improvements in Water Metres;* John Ericsson, City of New York, December 9.

Claim.—"What I claim as my invention is, 1st, The uniform circular channel *a a*, in combination with the contracted channel *b*.

"2d, I claim the rotating paddle wheel, having paddles projecting into and working in the said uniform and contracted channels.

"3d, I claim the apertures *m* and *n*, proportioned and formed as described.

"4th, I claim the pipe *g*, with its jet *r*, for giving motion to the paddle wheel before the fluid enters through the aperture *m*.

"5th, I claim the valve *k*, by which any desirable power of jet may be obtained, before any fluid enters through *m*."

27. For an *Improvement in Chucks for Lathes;* Joseph Hyde, Troy, New York, Assignor to Thos. J. Eddy, Waterford, New York, December 9.

Claim.—"Having thus described my improved chuck, what I claim therein as new is, the mechanism herein described, or the equivalent thereof, for connecting and disconnecting, at will, the whole or any part of the screws which operate the griping jaws, with the wheel which turns them, so that the screws and jaws may be moved either separately or in connexion, or in part separate and in part connected, whereby objects of either regular or irregular shape may be chucked, either eccentrically or concentrically with the axis of the mandrel, substantially as herein described.

"I also claim the turning plate (I) of the chuck, constructed with a cog wheel on its inner face, made in segments, part of which can be withdrawn out of gear with the pinions on the carrier screws, or held in gear therewith by means of set screws and springs, or the equivalent thereof, substantially as herein set forth."

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28. For an *Improvement in Feeding Logs in Saw Mills;* Charles Ketcham, Penn Yan, New York, December 9.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, the combination of any number of adjustable rollers, which may be set at any angle with the feed rollers, or with each other, for the purpose of feeding up the log, so that it may be cut with the curve or grain of the wood, substantially in the manner as herein set forth and described."

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29. For an *Improved Arrangement of Pans for Washing Ores, Minerals, &c.;* Sam'l. Porter, Hartford, Connecticut, December 2.

Claim.—"I do not claim the device of arranging a movable pan in a vibrating frame, and of operating the same, so as to give a double motion to the pan, since letters patent for this invention have been granted to Arnold Buffum and Philip Thorp. What I claim as my invention is, the arranging and operating of a series of ore-washing pans, or sets of pans, in a vibratory frame; said pans or sets of pans, having also an oscillating or rocking motion, in the frame, in such a manner that as the superficial portion of the contents passes freely from any one pan or set of the series into the next, the contents shall, at the same time, pass out of the latter less freely, or not at all, and *vice versa*, substantially as already described.

"2d, I claim, also, the arranging in a vibrating frame, of a series of pans, or sets of pans, one after the other, each pan or set being hung upon the frame by a separate axle, or equivalent attachment, and secured in its working position by a catch, or other equivalent means, in such a manner that each pan, or set, may be conveniently disconnected and tilted, so as to discharge its whole contents into a receptacle, separate from those of the other pans.

"3d, I claim also, the arranging of a succession of groups of pans, by a constant duplication for the subdivision of the contents, in such a manner, that the contents issuing from each pan of any one group, the last excepted, shall pass, by an equal division, into the two pans of the next succeeding group, substantially as described."

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30. For an *Improvement in Car Seats;* Ezra Ripley and E. L. Brundage, Troy, New York, December 9.

Claim.—"Having thus described the nature of our invention, what we claim as new is, the arrangement of the reversing arms pivoted midway the height of, and to the back, so as that they shall descend and slide through the pivot rollers, so as that any required height of back may be reversed from one side of the seat to the other, in the manner and for the purpose, substantially the same as described."

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31. For *Improvements in Lath Machines;* G. W. Tolhurst, Cleveland, Ohio, December 9.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, so arranging the frame that carries the reciprocating or chopping knives and feeding apparatus, as that whilst cutting, it shall at all times rest by its own weight on the bolt, or log, in advance of the portion thereof which is being cut, in combination with the mode as herein described, of giving to the knives carried in said frame, an alternating

drawing movement towards and from the log, independent of the downward motion or position of the frame, by which means the block may be entirely reduced to laths, while the whole weight of the knife frame is resting on it, to keep it firm and solid.

"I also claim, in combination with the cutter stock, the feeding plate for feeding up the log to the cutters, a "throw" being given to said stock for that purpose; and this I claim, whether the same is accomplished by the means herein specially set forth, or by any other means essentially the same."

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32. For an *Improvement in Running Gear of Railroad Cars;* Thomas A. Davies, City of New York, December 9.

Claim.—"What I claim as new and original is, adapting to each side of railroad car tracks, four or more wheels attached to a frame work, inflexible vertically, but with a horizontal motion, in such a manner, that in case of depressions in the rails at their joinings, or otherwise, they (the wheels) will alternately be couplets, triplets, or the like, receive the weight of the load above, and relieve the wheel passing over the depression, from the weight of the load and frame work, so that no concussive blow is struck with that weight or jar created, substantially as above described."

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33. For an *Improvement in Chair Seats;* John W. Drummond, Skaneateles, Assignor to Smith Ely, New Brighton, New York, Dec. 16.

Claim.—"What I claim as my invention is, the above combination of the frame and web, being the mode of securing the web to the frame, as herein set forth, by gluing or cementing the web into a groove in the frame."

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34. For an *Improvement in Weavers' Temples;* Elihu and Warren W. Dutcher, North Bennington, Vermont, December 16.

Claim.—"What we claim as our invention is, the roller temple, constructed as herein set forth; the roller working in a concave, so that the cloth is held at that line of the periphery of the roller which is nearest the reed, at which line the roller is enabled to perform its duty with the greatest efficiency."

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35. For an *Improvement in Combining Organs and Piano Fortes;* Richard M. Ferris, City of New York, December 16.

"The nature of my invention, which relates to the combination of certain or all of the tubes of the organ with the piano-forte, consists, not in the combination, but in the manner of effecting it, so that either the piano-forte or organ can be played separately, both at the same time by the same set of keys, or one by one hand and the other by the other hand of the player, each being provided with a separate set of keys, and either set being capable of being coupled with the other set, so as to be operated at the same time.

"It also consists in the employment of a set of pedals, for operating on certain or all of the piano-strings and organ pallets; the said pedals are capable of being coupled with either the organ or piano keys, or both, or uncoupled altogether."

Claim.—"I do not claim combining the organ and piano-forte, irrespective of the manner in which the combination is formed; but what I claim as my invention is, 1st, The whole or any number of the tubes of an organ, with a distinct set of keys, in combination with a piano-forte, having its own proper set of keys, in such a manner, that either the piano-forte or organ can be played separately, or both at the same time, by the two sets of keys, or both coupled and played by one set of keys, by means of couplers, P or O, and eccentric bars, *h*, *j*, or other equivalent devices, substantially as herein described.

"2d, Coupling either or both the organ and piano with a pedal action, R, *n*, Q, and uncoupling them from it, by means of couplers T, U, acting on the keys and eccentric bars *t w*, or their equivalents, so that either the organ and piano-forte, or both, can be played upon by the pedals, substantially as herein set forth."

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36. For an *Improvement in Carriages;* Gastavus L. Hanssknecht, New Haven, Connecticut, December 16.

Claim.—"What I do claim as my invention is, 1st, The employment of segments *c*, *d*,

and fifth wheels, F, G, (or parts corresponding thereto,) attached as described; the one segment, *d*, and fifth wheel F, working on pivots *f*, *n*, secured at points between the front and hind axle, such parts acting in combination with arms *j*, *p*, constructed substantially as shewn and described, for coupling the movement of two axles, or their turning appurtenances, for the purposes set forth."

37. For *Machinery for Making Kettles and Articles of like Character, from Disks of Metal;* Hiram W. Hayden, Waterbury, Connecticut, December 16.

Claim.—"I do not claim any of the gear wheels, or pinions, nor their arrangement, except as hereafter set forth, some of these being common in ordinary lathes; but I do claim as new, 1st, The application of a rotary metallic form or mould, or successive forms or moulds, in combination with a proper tool or tools, roller or rollers, sustained, moved, and directed in a proper path, by competent mechanical means, for the purpose of operating on a disk, blank, or plate of metal, so as to reduce it gradually from the centre to the edge, at the same time forming it with straight sides by successive stages, into a complete kettle, or into any similar articles, to the forming of which the apparatus can be applied, substantially as described and shown.

"2d, The construction of the mandrel *f* 3, part of which is cylindrical, and part fitted with a short screw, 13, to take the screw of the hand wheel, *f* 2, so that great pressure may be made at the point desired, while at same time, the mandrel can be easily and quickly moved through a long distance, for the purposes as described and shown."

38. For an *Improvement in Adjusting Lenses;* Wm. & Wm. H. Lewis, City of New York, December 16.

Claim.—"We do not claim to be the inventors of any of the parts herein described and shown; neither do we mean to limit the application of these means to cameras, but to use the same, to adjust the focal distance of lenses in optical instruments, wherever the same may be made available; what we claim as new and of our own invention is, the combination of the pin 2, spring *f*, and groove 1, with the cylinders *a* and *b*, for the purposes and as described and shown."

39. For an *Improvement in Stethescopes;* Nathan B. Marsh, Cincinnati, Ohio, December 16.

Claim.—"What I claim as my invention is, the double branch, *c c*, connected with the main trunk *a*, so as to enable persons to use both ears simultaneously, substantially as herein set forth and described."

40. For an *Improvement in Mineral Composition Resembling Jasper;* John Paige Pepper, New Britain, Connecticut, December 16.

Claim.—"What I claim as my invention is, the manufacture of a mineral composition, having the external characters above described, by the fusion of clay with alkali, soda, lime, and sulphate of copper, as above described, or their equivalents, and working the composition into articles of utility and ornament, in the manner above described."

41. For *Improvements in Rotating Tumbler Locks;* David H. Rickards and Jos. F. Flanders, Newburyport, Massachusetts, December 16.

Claim.—"We do not claim a combination of geared change wheels and notched circular plates, applied together on one common arbor, so that the said change wheels and circular plates shall lay side by side on the said arbor, by which arrangement of them, they require to be removed from the arbor, in order to change the catch of any one wheel from any notch or hole of its circular plate, into any other of the notches or holes of the said plate; but what we do claim as our invention is, combining with the rotary tumblers and the change gears (arranged as set forth) the projection or tooth *r*, or its mechanical equivalent, and the sliding frame G. (or its equivalent,) for holding and guiding the tumblers during their rotations, and for moving them out of or into connexion with the change gears, all substantially as herein before specified.

"And we also claim the arrangement of the tooth or bit c, and the stud g, on a sliding and turning shaft, in combination with the arrangement of the arm E, and the tumblers, so that when a person tries to move the tumblers, he cannot get end play on the bolt, and vice versa.

"And in combination with the change gears and the arbor e, we claim the friction spring or springs a^1, and plate b^1, for the purpose above described."

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42. For an *Improvement in Candlesticks;* Francis A. Rockwell, Ridgefield, Connecticut, December 16.

Claim.—"I do not claim the employment of a movable detached cork or other elastic substance, over which a sliding socket is allowed to move; nor do I claim the employment of a sliding socket; but what I claim as my invention is, the employment, in the sliding socket candlestick, of elastic packing attached to the standard of the candlestick, substantially in the manner described, whereby I am enabled to support the sliding socket, prevent the leaking of the grease, and also am not obliged to use so long a sliding socket, as where a cork is inserted loose in the socket."

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43. For an *Improvement in Chimney Tops;* Chas. W. Russell, Washington, District of Columbia, December 16.

Claim.—"I do not claim either the arch B, or the end plates C, C, or the end plates a a, and b b, irrespective of the devices in connexion with them; but what I claim as my invention is, 1st, the flanches, c c, applied to the arch B, in combination with the end plates C C, substantially in the manner and for the purpose herein set forth.

"2d, The inclined plates a a, and b b, applied to the arch B, substantially as and for the purposes specified."

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44. For an *Improvement in Churns;* Henry Skinner, Attica, New York, December 16.

Claim.—"Having thus described the nature of my invention and improvement, I wish it to be understood that I make no claim to originality of invention in any of the individual parts of the churn, except the dasher; and this I claim, only when it is constructed with inclined perforated paddles, and tapered elbow tube L, combined, for directing the cream or milk upward, and also throwing it centrifugally against the ribs B, and concave surface of the churn tub A, during the operation of churning, in the peculiar manner herein set forth."

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45. For a *Blind and Shutter Operator;* Noah W. Speers, Cincinnati, Ohio, December 16.

"The object of my invention is to provide a simple and secure method of operating and fastening outside window shutters and blinds, without opening the windows; and I have invented the present, in view of a number of contrivances which appear to me to be lacking in strength, when force is applied, such as high winds, &c."

Claim.—"Having thus fully described the nature of my improvements in window blind operators and fasteners, what I claim therein as new is, the combination of the extension handle k, (provided with taper ends,) with the lever h, and the studs j j^1, or their equivalents, by which the handle can, by extension, be made to possess the requisite leverage, and by which, when the lever arrives at that portion of its sweep, corresponding to the required position of the blind or shutter, it is firmly secured in its position, and the handle placed out of the way, by the latter being thrust home against the studs, the whole being arranged substantially in the manner described."

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46. For an *Improvement in Apparatus for Pressing Garments;* Jos. W. Thorp, South Weare, New Hampshire, December 16.

Claim.—"Having thus described my improvements, I shall state my claim as follows: What I claim as my invention is, suspending the goose in a tailor's pressing machine, from a carriage traveling on rails, on the end of a vertical spindle; also arranging said spindle, so that it may be moved vertically and swivel or turn upon its axis, substantially as herein above set forth.

"I also claim arranging said goose upon the rod, passing through the forked end of said spindle, so that it may slide forward and back upon said rod, as herein above set forth.

"Furthermore, I claim the combination of a goose, arranged substantially as herein above described, so as to move in the several directions specified, with a platform box, susceptible of adjustment, as specified, and heated substantially as herein above set forth."

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47. For an *Improvement in Processes for Smelting Copper Ores;* Samuel F. Tracy, City of New York, December 16.

Claim.—"That which I claim as my invention and discovery is, the use, as a flux for ores, combined with an excess of silica, of the sub-silicate of iron, obtained from the second smelting, or from iron furnaces.

"The grinding of the regulus or mat to a powder, (instead of merely breaking it into lumps or fragments,) so that a perfect oxidation can be obtained, and leaching with water, which aids the oxidation and extracts the sulphuric acid, when generated, as that acid greatly retards the refining process, when combined with the metallic copper."

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48. For an *Improvement in Tailors' Measures;* Edward Virtue, Philadelphia, Pennsylvania, December 16.

"The nature of my invention consists in proportioning all the measures of the body of coats and vests to the measure of the breast of the individual measured. The breast measure determines all others, except the sleeve measures and length of skirts."

Claim.—"What I claim as my invention is, the mode of cutting coats and vests, by making all the principal parts to depend, in length, on the length of the breast measure, substantially as herein described."

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49. For an *Improvement in Grain Sieves;* Thos. B. Wheeler, Albany, New York, December 16.

Claim.—"What I claim as my invention is, forming sieves for separating grain from straw, chaff, and all extraneous matter, and for other analogous purposes, of sheet metal, with apertures, B, B, cut or otherwise made in it, and inclined leaves A, A, under the said apertures, of corresponding form with the apertures themselves, substantially as herein set forth."

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50. For an *Improvement in Pumps for Elevating Water Mixed with Mineral Substances;* William Ball, Chicopee, Massachusetts, December 23.

Claim.—"I claim the improvement by which the waste auriferous or earthy water, that leaks out of the shaft hole of the case A, is saved and returned into the body of the case, and the wear of the shaft hole of the chamber *q* prevented; the said improvement consisting in the chamber *q*, the wheel *r*, and the passage *t*, as combined together, connected with the case A, and the shaft of the fan wheel, and made to operate substantially as specified."

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51. For an *Improvement in Chronometric Locks;* William L. Bass, Boston, Massachusetts, December 23.

Claim.—"Having thus described my improvements, I shall state my claim as follows: What I claim as my invention is, the manner of disengaging the drop lever from the notch of the bolt, from the outside of the partition, when the clock is stopped, and preventing the same from being effected when the clock is in motion, by means of the lifting screw, in combination with the forked lever, swinging loop, and ratchet wheel, substantially in the manner above described."

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52. For an *Improved Machine for Making Leather Tubes;* Newell Wyllys, South Glastonbury, Assignor to Charles Collins and N. Wyllys, Hartford county, Connecticut, December 23.

Claim.—"Having thus described the construction and operation of my machinery for forming flexible tubes, what I claim as my invention is, 1st, the method of forming the

blanks or sheets, of the proper size and form for tubes, from leather or other suitable material, by means of the movable and stationary nippers and inclined knife, or the equivalents thereof, operating automatically, substantially as herein set forth.

"2d, I claim the method of forming flexible tubes from prepared sheets or blanks, by means of fingers, clamps, and cement, or their equivalents, acting substantially as herein set forth, to bring the edges of the sheet into contact, and to unite the same.

"3d, I claim combining in a single machine, the operations of forming the leather or other material into blanks, bringing the edges of the same into contact, and uniting them, so as to form a tube at a single operation, substantially as herein set forth.

"4th, I claim the clamp, by means of which the material is held, and upon which it is formed into a tube, constructed and operating in such manner that it shall, in addition to its movements towards the other clamp, also have a longitudinal movement to withdraw from the finished tube, substantially as described.

"5th, I claim the combination of the reciprocating diverging fingers with the reciprocating converging plates, or their equivalents, by whose action the fingers are made to seize the sheet of material, substantially as herein set forth.

"6th, I claim the method of coating the edge of the sheet with cement, by means of a roller, or its equivalent, which receives the cement, and applies it to the edge to be cemented, substantially in the manner and for the purpose herein set forth.

"7th, In combination with a clamp, or its equivalent, for supporting the e lges of the sheet of material to be united, I claim a reciprocating pressing iron, actuated substantially as herein set forth, to press the edges together and to set the cement."

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53. For a *Rotary Swaging Machine;* Perry G. Gardiner, City of New York, December 23.

Claim.—"What I claim as my invention, discovery, and improvement, is, the compressing, drawing, swaging, or working into shape, wrought iron car wheels, and other metallic disks, by means of two dies or swedges, suitably shaped, one of which is forced towards the other, while it at the same time revolves on its own centre, its axis of revolution being the same as that of the disk which is acted upon; the other die being either stationary, or having a revolving motion in an opposite direction to that of the first mentioned die, and with the same axis of revolution; the said two dies or swedges operating substantially as described, and being moved by any competent arrangement of machinery, substantially as described."

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54. For an *Improvement in Suspenders;* Julius Hotchkiss, Assignor to the Hotchkiss and Merriman Manufacturing Co., Waterbury, Connecticut, December 23.

"My improvement consists in fastening the different pieces or parts of the suspender together, wherever a permanent fastening is necessary, by means of a metallic clamp of peculiar construction, made and applied."

Claim.—"What I claim as my invention is, the fastening of those different parts of a suspender to each other, which require a permanent fastening, by a metallic clasp or clamp, substantially in the manner and for the purposes hereinbefore described."

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55. For an *Improvement in Candle Making Apparatus;* Willis Hurniston, Troy, New York, December 23.

"The nature of my invention consists in the manner of wicking the mould, by suspending the candles or wick above the same when drawn, so as that the wick shall draw from a reel, and suspend it in the centre of the mould, for the next succeeding candle to be moulded thereon, in the operation of drawing the candles from the moulds."

Claim.—"Having thus described the nature of my invention, I do not wish to be understood as claiming the drawing the candles and suspending them above the moulds, whereby the latter are wicked for the casting of the next series of candles, this having been before done; but what I do claim is, the employment of gripers for griping the wicks, drawing and suspending the candles on the frame above the moulds, by means of spring bearings, by which the gripers are held firmly closed, and the candles are securely held and suspended until the next series of candles are moulded, when those suspended are cut from the wick and removed, in the manner and for the purpose described."

56. For an *Improvement in Æolian Attachments;* Gustavus W. Ingalls, Concord, New Hampshire, December 23.

Claim.—"What I claim as my invention or improvement is, the combining with the valve stem or rod, a movable bar, or any equivalent mechanism, by which such valve stem, or the head thereof, whenever desirable, may be moved out of action with the key lever, for the purpose essentially as described."

57. For an *Improvement in Carriages;* Lewis King, Madison, New York, December 23.

Claim.—"Having thus described the nature and operation of my invention, what I claim as new is, the employment or use of the chain and pulley, in combination with the dogs and slide bar, constructed and operating in the manner and for the purpose substantially as set forth; the lower ends of the dogs being raised or depressed by means of the levers, operated upon by the square or loop, or any other equivalent device, and the slide bar attached to or detached from the pole by means of the levers and pawl, operated upon by the bent lever, or their equivalents."

58. For an *Improvement in Harness Saddles;* John McLain, Circleville, Ohio, December 23.

Claim.—"Having thus fully described my improved harness saddle, and the advantages thereof, what I claim therein as new is, the sliding gauge hinge boxes, attached to the pads, so as to adjust the width of the saddle by the screws, substantially as described.

"I also claim the manner of attaching the sliding gauge hinge boxes to the pads by means of the housings between them and the top of the pad, and the set screws passing through the plate *f* and top of the pads, substantially as herein set forth."

59. For an *Improvement in the Method of Hanging Window Sashes;* Samuel D. Nims, Palmer, Massachusetts, December 23.

Claim.—"I am aware that strips acted upon by springs have been placed in grooves in window sashes, and also in grooves in the casing, for acting on the sashes for the purpose of excluding air, and for sustaining the sashes when raised, in place of weights, and therefore I wish it to be understood that I do not claim the said arrangements as any part of my invention. But what I do claim as my invention is, the manner herein described of arranging and securing window sashes in their frames, by means of grooves in the sides of the window frame or casing, that receive the edges of the sashes, or by projections from the sides of said frame or casing, that fit into grooves in the edges of the sashes, and by making one or both sides of the window frame or casing movable and elastic, by means of the springs or their equivalents."

60. For *Improvements in Cutters for Planing Machines;* James M. Patton and Wm. F. Fergus, Philadelphia, Pennsylvania, December 23.

"The nature of our invention consists in the peculiar construction and operation of a cutting instrument to be employed in planing machines, for reducing the boards to an uniform thickness, and in a modified form, for reducing the boards to an uniform width, and for tonguing and grooving them."

Claim.—"We do not claim the formation of cutters by placing circular saws obliquely upon their arbors, as this has been done before; but what we do claim as our invention is, the constructing of a cutting instrument for operating upon lumber, of one or more elliptical shaped saw or saws, placed upon an arbor, in positions so oblique to the direction of its axis as to bring every portion of the periphery of said saw or saws into the same perpendicular distance from the said axis of their arbor, by which the teeth of the said saw or saws are made to perform a combined rotary and laterally reciprocating cutting action in the same circle of rotation, substantially in the manner herein set forth."

61. For an *Improvement in Apparatus for Making Wrought Iron direct from the Ore;* James Renton, Newark, New Jersey, December 23.

Claim.—"I do not wish to limit myself to the use of a puddling furnace for the final operation, nor to the use of mineral coal, as the same result, in kind, may be produced by

a bloomery. What I claim as my invention is, the arrangement of a series of flat vertical tubes, or the equivalent thereof, in a vertical stack, substantially as described, when these are combined with a puddling or other furnace, substantially as described, by means of an interposed ore box, substantially as and for the purpose specified.

"I also claim combining with each of the deoxydizing tubes, as described, and at the middle and lower end thereof, a double inclined plane, substantially as described, to insure the equal descent of the charge of ore, as described.

"And I also claim, in combination with the series of the oxydizing tubes and the ore box, substantially as described, the employment of a series of stationary and a series of adjustable inclined planes, substantially as described, to regulate and insure the equal discharge of the ore from each, and from the whole series of tubes, as described."

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62. For an *Improvement in the Method of Setting up Ten Pins;* Thomas E. Shull, Lewistown, Pennsylvania, December 23.

Claim.—"Having thus described the nature and operation of my invention, what I claim as new is, attaching the pins to a disk or plate by means of cords, in combination with the adjusting screen and guide screens, by which the pins are properly adjusted or set up on the alley, upon raising and lowering the disk or plate, as described; the disk or plate being operated by means of the cord passing over the pulleys and around the wheel, power being communicated to the shaft, or by any other mechanical means."

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63. For an *Improvement in Machines for Counting Screws and Pins;* Thomas J. Sloan, City of New York, December 23.

Claim.—"What I claim as my invention is, the cylinder or wheel formed with recesses in its periphery, for the reception of the screws or other articles to be counted, and provided with a groove for the reception of and in combination with the detector, to indicate, mark, and register the number of screws or other articles that are delivered; the whole being constructed and made to operate substantially in the manner specified."

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64. For an *Improvement in Bolt-heading Machines;* Nathan Starks, Albany, New York, December 23.

"The machine represented in the accompanying drawings is arranged to form square heads upon bolts; it consists mainly of a strong frame, to support the various moving parts of the machine; of a set of griping dies, to gripe the neck of the bolt blank, on which a head is to be formed; of the punch and its stock, for thickening or upsetting the extremity of the bolt blank; of the shaping dies, for giving form to the thickened extremity of the bolt blank, and of the mechanism by which the punch and dies are operated."

Claim.—"Having thus described my improved machine for heading bolts, what I claim therein as new is, the combination of the upsetting punch, the dies for shaping the sides of the head, the levers for working the dies, and the protuberance on the punch stock for actuating the levers, so that by the forward movement of the punch stock, the punch is caused to upset the end of the bolt, and by its retrograde movement the dies are worked, which give shape to the sides of the head, as herein set forth."

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65. For *Improvements in Spinning Rope Yarns;* Richard Sands Tucker, Brooklyn, New York, December 23.

"The nature of my invention consists in spinning yarns for cordage, upon bobbins having movable head or movable heads, so that the yarn can be packed tightly upon the bobbin in spinning, and when full, the yarn can be removed from the bobbin, whereby the inner end of the thread or yarn can be hauled or drawn out, in the process of rope making, in forming the "readies" or strands of cordage; thus saving much expense in labor and bobbins, besides the great advantage of hauling or drawing out the yarns or thread from the inner end."

Claim.—" What I claim as my invention is, spinning rope yarns upon bobbins having movable head or heads, so that the yarn can be packed tightly upon the bobbin in spinning, and after spinning can be removed from the bobbin, to be transferred and hauled off into strands for cordage from the *inner* ends thereof, without unwinding, thus effecting a great saving of bobbins and labor."

66. For an *Improvement in Machines for Dressing Stone;* William Wheeler, West Poultney, Vermont, December 23.

"My improvement consists in the cylindrical tool-holder, in which the cams revolve that cause the tools to act upon the stone; the said cylinder acting as a support to the cams and shaft; and it also enables me to bring the tool on to the stone in any direction, cutting equally well when the carriage is moving forward or back, or while cutting over the top surface, or up and down the ends."

Claim.—"Having thus fully described my improvements in cutting stone by machinery, what I claim therein as new is, the cylindrical tool-holder, constructed and arranged substantially as herein set forth, so as to hold the tools or chisels, and turn them in a direction to cut either way, keeping them in such position as always to receive the blows from the cams in the same relative direction, and also incidentally to support the cam shaft, by means of the cams resting against its interior, should the cam shaft spring."

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67. For an *Improvement in Machines for Ruling Paper;* John Ames and George L. Wright, Springfield, Massachusetts, December 23.

"The machine hereinafter described is for the purpose of ruling a sheet of paper on both of its opposite pages or sides, and down the page, so as to have a heading or margin at the top of each side or page."

Claim.—"Having thus described our improvements, what we claim is, 1st, the shaft and its projections, (operating as above set forth,) or any mechanical equivalent contrivances, in combination with the carrying apparatus, or endless tapes, on which the sheets are received, moved, and introduced to the action of the ruling apparatus, such carrying apparatus being made so as to operate essentially as above described.

"And we also claim the shaft and its lifters, in combination with the carrying apparatus or endless strings, and the two sets of ruling apparatus, or contrivances for supporting and ruling the paper on both sides, as described, such shaft and lifters, or the lifting apparatus, as it may be termed, being for the purpose of changing the overlap of the sheets, in manner as herein before explained."

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68. For *Improvements in Attaching Cutters for Cutting Screws on Rails of Bedsteads;* Jacob Zimmer, Tiffin, Ohio, December 23.

Claim.—"Having thus described my improvement in securing V-shaped cutters in rotary cylinder heads for cutting screws on tenons of bedstead rails, I wish it to be understood that all I claim as my invention is, forming an opening in the end of the cylindrical head, so as to allow the cutter to be placed therein laterally, or inserted into its seat sideways, and securely confined, in the manner herein before set forth, whereby the cutter requires no adjustment, and is retained firmly in its position."

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69. For an *Improvement in Setting Mineral Teeth;* John Allen, Cincinnati, Ohio, December 23.

Claim.—"What I claim as my invention is, the new mode of setting mineral teeth on metallic plates, by means of a fusible siliceous cement which forms an artificial gum, and which also unites single teeth to each other and to the plates upon which they are set.

"I also claim to be the inventor of said cement or compound, a full and exact description of which is herein given.

"I also claim the combination of asbestos with plaster of paris, for covering the teeth and plates, for the purpose of sustaining them in their proper position while the cement is being fused."

RE-ISSUES FOR DECEMBER, 1851.

1. For an *Improvement in the Manifold Permutation Lock, for Doors, Vaults, &c.;* Robert Newell, City of New York; patented September 25, 1838; re-issued December 2, 1851.

Claim.—"What I claim as new and of my invention is, 1st, the application of slides or their equivalents, in combination with tumblers, each so constructed that the slides shall be set through the tumblers by a key or any arrangement of the key-bit sections, or the

equivalents of the same, and then retained as set by any competent means, so that notch tumblers resuming their quiescent positions, they abut against the slides, and prevent the retraction of the bolt, substantially as described and shown, but independent and irrespective of the means used to secure the slide in place.

"2d, I claim the manner of fitting the slides with the cramp and nut, so as to retain the slides in the position they have been placed in by the key-bits and tumblers, as described and shown.

"3d, I claim constructing the barrel of the key-bit in such a manner, that it may be inverted with reference to the handle or shank, substantially in the manner and for the purposes herein described."

Designs for December, 1851.

1. For a *Design for Stove Registers;* David Stuart and Jacob Beesley, Assignors to William P. Cresson, Philadelphia, Pennsylvania, December 2.

Claim.—"What we claim as our invention is, the ornamental design for a register, as herein described and represented in the annexed drawings."

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2. For a *Design for Stoves;* Jeremiah D. Green, Troy, Assignor to Backus, Bacon & Co., Le Roy, New York, December 9.

Claim.—"What I claim is, the ornamental design and configuration of a cook stove, substantially the same as described and represented in the annexed drawing."

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3. For a *Design for Stoves;* Winslow Ames, Assignor to Hartshorn & Ames, Nashua, New York.

Claim.—"The said design consists of the ornamental semi-star and rays and mouldings of the end or side of the top plate, (as seen in the drawings,) the circular ornament A, and four or more surrounding ornaments, B, C, D, E, together with the mouldings of the top and bottom plate, all essentially as represented in either of the side or end views, and their sections; and such ornamental design, substantially as exhibited in the above mentioned drawings, I claim as my invention or production; and I also claim the ornamental design or configuration of the water urn, as shown in figures 1, 2, and 3."

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4. For a *Design for Frames for Presses, Mantel Pieces, &c.;* Edwin L. Freeman, Belleville, New York, December 23.

Claim.—"What I claim as new is, the design of the frame for presses, mantel pieces, &c., above described."

JANUARY, 1852.

1. For an *Improvement in Ventilating Railroad Cars;* Noble S. Barnum and Lewellyn Whitney, New Haven, Connecticut, January 6.

"My invention consists in the employment of an axle, or shaft, (which is designed to be used in connexion with the car ventilator,) and which is placed on the bottom of the car, the ends of which shaft being secured in movable or sliding boxes, which operate in combination with the loose pulleys, &c., in such a manner as to allow the cars to travel over curved tracks, without the necessity of employing elastic belts."

Claim.—"What we claim as our invention is, the employment of the shaft O, sliding boxes *g*, and the springs *k;* the whole operating in combination with the pulleys, R, T, in the manner and for the purpose herein set forth."

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2. For an *Improvement in Carriage Hubs;* Samuel S. Barry, Brownhelm, Ohio, January 6.

Claim.—"What I claim as my invention is, the combination of the conical bearing point F, (fig. 2,) the female centre, or step D, the thimble N, rollers M, and flanch E, arranged in the manner substantially as described, and for the purpose set forth."

3. For an *Improvement in the Construction of Bridges;* Wendel Bollman, Baltimore, Maryland, January 6.

Claim.—"Having thus fully described my improved construction of bridges, what I claim therein as new is, the combination of the tension rods *e*, connecting the foot of each strut with each end of the stretcher, substantially as described, by which an independent support is given to the strut carried back directly to the abutment, while, at the same time, no lateral force or strain is brought upon the abutment, as herein fully set forth."

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4. For an *Improvement in Modes of Covering Cheeses;* Upson Bushnell, Gustavus, Ohio, January 6.

Claim.—"I claim as my invention, the spring cylinder with cleats, and open at the side, in combination with the framed stool, with circular opening, to admit and hold the cylinder within the sack, while the cheese shall be passed through; all as herein described and for the purposes stated."

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5. For an *Improvement in Lock for Carriage Curtains;* George Cook, New Haven, Connecticut, January 6.

Claim.—"What I claim as my invention is, the constructing or manufacturing of coach curtain locks, each consisting of a polygonal knob and an eyelet having a polygonal central aperture of corresponding form and size, so that at certain relative positions, the knob head will pass freely through the eyelet, while in other relative positions, the knob cannot pass through the eyelet, on account of the prominence of its angles.

"I also claim attaching the knobs and eyelets to the articles which are to be thereby connected, in such relative positions, that the knob head cannot be made to pass through the eyelet, either for the purpose of connecting or disconnecting, unless the eyelet or knob is turned from its ordinary and proper position; both the knob and eyelet being constructed in the manner and for the purpose herein described."

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6. For a *Machine for Turning up the Edges of Sheet Metal Disks;* Jos. F. Flanders, Newburyport, Assignor to Franklin Roys and Edward Wilcox, Berlin, Connecticut, January 6.

Claim.—"I do not claim as my invention, the use of cylindrical rollers, for either bending or beading a circular tin plate, when held between and rotated by holders or gripers; but what I do claim is, the employment of the spherical segmental bending roller *k*, in connexion with the conic frustum roller *a*, to operate together, and so as to enable me to either turn down the flanch at a right, acute, or obtuse angle, all essentially as specified, and at the same time dispense with the necessity of having several sets of holders or gripers, to bend the tin plate against, as heretofore practised."

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7. For an *Improvement in Clover Harvesters;* Mahlon Garretson, Bermudian, Pennsylvania, January 6.

Claim.—"Having thus described my improvements in the clover head harvester, what I claim therein as new is, the lateral projections whose ends are fitted into the mortises or recesses in the shanks of the cutters, and whose upper front edges are made sharp; said projections serving the two-fold purposes of interlocking with the contiguous cutters and acting as cutters themselves, as described, for severing the heads from the stalks."

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8. For an *Improved Steam and Water Gauge;* Wm. C. Grimes, Spring Garden, Philadelphia, Pennsylvania, January 6, 1852; ante-dated July 6, 1851.

Claim.—"What I claim herein as my invention is, the combination of the elevated glass syphon, containing a portion of air above, with the metallic tubes containing water below, arranged with respect to each other and the index, as herein described, for the purpose of showing or indicating the height of the water, and also the pressure of the steam, in steam boilers, at an elevation above or at the desired distance therefrom."

9. For an *Improvement in Camphene Lamps;* R. V. De Guinon, Williamsburgh, New York, January 6.

"The object of my invention is to obviate explosion; and the nature of it consists in constructing the reservoir of the lamp with a false bottom, or chamber, communicating with which and the reservoir near the top, is a tube or passage, that serves to receive and conduct the camphene or other fluid, as it increases in volume by expansion."

Claim.—"What I claim as my invention is, constructing lamps with a lower chamber or equivalent receptacle thereto, such chamber or receptacle being connected with the reservoir near its top, by a tube or passage, or other similar communication, substantially in the manner and for the purposes set forth."

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10. For an *Improvement in the Manufacture of Railroad Chairs;* Peter P. R. Hayden, Columbus, Ohio, January 6.

"The nature of my invention consists in forming the chair out of wrought flat plate, or bar iron, made with convex raised surfaces therein, on its one side, which when the bar is cut to the required length for the formation of a chair, serve to make the lips thicker, at or near the roots, when cut and bent, without incurring any extra labor, to give additional and requisite strength at those parts."

Claim.—"What I claim as my invention is, rolling iron plates for rail road chairs, upon rollers so constructed that the portions intended to form the lips of the chair, shall have a greater thickness than the rest of the plate, substantially as herein set forth."

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11. For *Improvements in Iron Railings;* George Hess, Assignor to Sylvanus Shimer, Easton, Pennsylvania, January 6.

Claim.—"I do not claim as my invention any of the parts of the within described railing, nor any of its minor combinations separately; but I do claim a combination, consisting of the following enumerated parts, viz: the top rail with its notches and end hooks; the lower rail with its notches, end hooks, and groove; the palings with their notches, hooks and T's; the posts with their openings for the ends of the rails, and the key bar by which the rails, posts and palings are firmly fastened together; the whole constructed and arranged substantially as herein described."

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12. For an *Improvement in Daguerreotype Pictures;* Henry E. Insley, City of New York, January 6.

"The nature of my invention consists in producing an image of greater boldness and relief at the same time, casting a halo of various tints around the image, gradually blending in the dark or black outer edge."

Claim.—"What I claim as my invention is, the contracted opening to the mercury bath, and the separating or raising the plate from the contractor, during the operation of mercurializing; thus graduating the mercury upon the plate, producing the varioua tints, and gradually blending the outer edges of the gauge."

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13. For an *Improvement in Wool Picking Machines;* Edward Kellogg, New Hartford, Connecticut, January 6.

Claim.—"I do not claim any improvement in the feeding table, ratchet feed roller, main picking cylinder, or any separate parts of the above described machinery. What I do claim as new and as my invention, is the application and use of the comb-plate to the upper and forward edge of the shell, when combined with the compound shell, to hold the comb-plate as above described; the several parts thereof being combined for the purpose aforesaid.

"And I claim the small recess just below the upper edge of the shell, for the purpose described and set forth."

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14. For an *Improvement in the Construction of Shovels;* Hiram Kimball, Worcester, Massachusetts, January 6.

Claim.—"What I claim as my invention is, an improvement in the construction of

the common shovel, as follows, to wit: 1st, the attachment of malleable iron or other metal, consisting of the lip, the flanch, and the socket, and the mode of fastening the same to the blade, as herein before described.

"2d, The mode of fastening the lower end of the stock of the handle, by means of a socket and single strap, with the ends deflected upwards on the front and back side of the stock, and thus connecting the handle with the blade of the shovel.

"3d, The construction of the upper end of the handle, consisting of the socket, the ribs, the cylinder and the rivet, and the mode of connecting the same with the upper end of the stock, by means of the socket, as substantially and fully herein before set forth."

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15. For *Improvements in Felting Cloth;* Joseph Weight, Lawrence, Assignor to Samuel Lawrence, Boston, Massachusetts; patented in England, October 7, 1841; January 6.

Claim.—"Having thus described my improvements in the manufacture of felted fabric, I shall state my claim as follows: I do not claim the manufacture of felted cloth generally, nor do I claim the use of flat platens in felting cloth; but what I do claim is, the felting of wool or other fibrous materials, upon a woven or netted fabric, substantially as herein above set forth.

"And I also claim the use of one or more moving platens, having a reciprocating rectilinear motion, in the direction of the length of the cloth to be made, over one or more stationary platens, in combination with the endless cloth bands, operated substantially as described, for carrying forward and regulating the motion of the material, while under the action of the said platens, substantially as set forth."

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16. For an *Improvement in Breech Loading Fire Arms;* Richard S. Lawrence, Windsor, Vermont, January 6.

Claim.—"What I claim as my invention is, mounting the barrel on a spindle attached to or projecting from the breech piece, so that the barrel can be turned thereon, to carry the bore to the side of the breech, for the insertion of a cartridge, and back to close the bore against the breech piece, substantially as herein described; but this I only claim in combination with the stationary breech piece, provided with a cutting edge at the side, to cut off the rear end of the cartridge, and with a projection at the top, extending over the barrel, and grooved transversely, to receive a lip from the barrel, to bind the barrel to the breech piece, to resist the force of the discharge, as herein described."

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17. For an *Improvement in Feeding Rollers in Straw Cutters;* Nathaniel Nuckolls, Columbus, Georgia, January 6.

"My improvement consists in presenting the straw sideways to the knives, and causing it to move against stationary knives, when cutting, instead of moving the knives against the straw."

Claim.—"Having thus fully described my improved straw cutter, what I claim therein as my invention is, the enlargement of the knife grooves on the feeding cylinder in the manner and for the purpose set forth."

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18. For an *Improvement in Processes of Bleaching Ivory;* Ulysses Pratt, Deep River, Connecticut, January 6; ante-dated July 6, 1851.

Claim.—"I do not claim the bleaching of ivory upon a frame exposed to the rays of the sun passing through glass, placed above the same; but what I do claim as my invention is, the improvement in the process of bleaching ivory, as set forth in the specification, that is to say, the raising up of one edge of the piece of ivory above the plane of the frame which supports it, and sustaining it in its place, in the manner described."

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19. For an *Improvement in Pen and Pencil Cases;* John W. Ranch, City of New York, January 6.

Claim.—"I do not claim the extension case, as a sliding tube working in a case has been previously invented; neither do I claim a slide case for both pen and pencil, as that

is at present in use; but what I claim as my invention is, the collar encompassing and sliding freely on the pencil tube, said collar having a slot or recess cut through it, as shown and described, through which the spur of the pencil slide may pass, by which arrangement either the pencil slide or pen holder may be operated without interfering with each other; the collar being prevented from turning on the pencil tube by means of the spur working in the slot in the sliding tube, and also by which arrangement, I combine the extension case with the slide case, for both pen and pencil, substantially as set forth."

20. For an *Improvement in Gold Pens;* Adam W. Rapp, Philadelphia, Pennsylvania, January 6.

"By this improvement the gold pen is made to embrace all the qualities of the quill pen, and in this, I consider, lies a superiority of my improvement over all others; but the more prominent advantage is in the saving of gold, by the reduction of the thickness at *a*."

Claim.—"Therefore what I claim as my invention and improvement in the gold pen is, reducing or thinning the sides of the pen at (*a*,) between the shoulder A, and split (*c*.) whereby the advantages above stated are fully attained, and the gold pen made to possess the qualities of the quill pen."

21. For an *Improved Mechanical Gold Beater;* Robert B. Ruggles and Lemuel W. Serrell, Assignors to Robert B. Ruggles, City of New York, January 9.

Disclaimers and Claims.—"We do not intend to confine or limit ourselves to the application of these means to beating lumina or leaves of metal, but to use this machine to beat any article to which it may be applicable; for instance, the "turn over" motion may be applied to a plate or similar article, or articles, that require to be beat on both sides, and the arrangement herein shewn, of means for extending or decreasing a given motion, may be applied to move any article in the given direction, and extend or decrease the area of such motion, as required. And it will also be seen, that this means of taking motion from the motion of the hammer tail to give definite motion from an uneven or varying motion, may be employed in other machines, for the like purposes; and we do not intend to limit ourselves to the sizes or proportions of the parts, nor their precise arrangement, relatively with each other, but to vary these as circumstances may require.

"We do not claim the hammer, or the means of moving or actuating the same; neither do we claim the use of cams to move the mould; but what we desire to secure by letters patent of the United States is, 1st, we claim the arrangement and application of the vibratory fork g, to take a definite amount of motion from the vibratory part g^1, of the hammer, for the purposes, and as described and shown.

"2d, We claim lifting the "mould," or its equivalent, from the anvil, and simultaneously or subsequently turning the same by competent mechanical means, substantially such as herein described, or their equivalents, so that it is replaced with the side that was previously on the anvil exposed to the blows of the hammer.

"3d, We claim the arm n 1, latch 30, levers o and o 2, chain 33, and crank o 3, or their equivalents, in combination with a weighted arm, or its equivalent, whereby a sudden partial rotation is given to the shaft o 1, and then the lever o is returned behind the latch 30, for the purposes and as described.

"4th, We claim, in combination, the lever q, latch 41, cranks 35, frame t, and links 38, or their equivalents, whereby the "mould" or its equivalent is lifted from the anvil, turned, and replaced as described.

"5th, We claim the application of the rollers 71, 72, 73, and 74, or other suitable mechanical means, set and moving at right angles with each other, and to the centre of the cam shaft, to take and communicate the motion given by a properly formed groove, or bead, in or on the face of the cam H, to the mould, so as to place it in the proper position to receive the blows of the hammer, to beat each successive quarter of the mould, as described.

"6th, We claim moving the mould, or its equivalent, over areas of different size, by means of the same cam, through the agency of mechanical contrivances substantially such as herein described, applied to the devices which transmit motion from the cam to the mould.

"7th, We claim the arrangement of the slides y y 1, rollers 68, forks 70, with the cranks w 2, w 3, and v v 1, and levers w and x, to communicate the motion given by the

cam H to the rollers 71, 72, 73, and 74, to the "mould" through its frame *s*, substantially as described and shown.

"8th, We claim the adjustable fulcrum 53, and slides *v* 4, in combination with the levers *w* and *x*, for the purposes specified.

"9th, We claim the parallel motion bars *u*, and slotted bars *u* 2, in combination with the slots 46 and 47, in the frame *s*, whereby the "mould" and frame has a free motion, at the same time that it is kept parallel with the sides of the anvil, or the slotted bar *u* 2.

"10th, We claim the arrangement of the forked springs *w* 4 and *x* 1, and pins 58, 59, and 62, 64, or their equivalents, as applied to the purpose of returning the "mould" to its central position, when commencing to beat each quarter of the "mould," as described and shown."

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22. For an *Improvement in Trucks for Locomotives;* John L. White, Corning, New York, January 6.

Claim.—"Having thus fully described my improved truck, what I claim therein as new is, the joint connecting the truck with the boiler, consisting of a long semi-cylindrical bearing and an adjustable eccentric, for putting the truck in line, substantially in the manner and for the purposes set forth."

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23. For an *Improvement in Cast Iron Car Wheels;* Horace W. Woodruff, Watertown, New York, January 6.

Claim.—"What I claim as my invention is, casting a railroad car wheel with a chilled rim and solid undivided hub, connected by means of a plate, which is single and solid at certain parts, so that imaginary radial lines from hub to rim will pass through the said solid parts, and double and bent in opposite directions, between the single and solid parts, and wholly or partly from hub to rim, substantially as specified; the whole constituting one casting, substantially as and for the purpose specified."

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24. For an *Improvement in Ventilating Windows for Railroad Cars;* Henry M. Paine, Worcester, Massachusetts, January 6.

Claim.—"I am aware that repeated attempts have been made to prevent the sparks from entering the cars, by deflecting boards or slats, but they have been outside, or independent of the windows; they could not be adjusted by the passengers themselves; they are an additional expense, and cannot effectually shield off the dust and sparks, unless they should cover the window, so as to obstruct the view therefrom; therefore, I do not wish to be understood as not claiming a deflector: but what I do claim as my invention is, the construction and arrangement of the windows of a car or carriage, in the manner and for the purpose set forth, by causing the parts of the window to stand at an angle outward when closed, and opening inward to a line with the inside of the car, as described; whereby I insure ventilation, without the annoyance of dust, by means of the window alone, without the addition of other deflectors."

LAW REPORTS OF PATENT CASES.

Battin vs. Taggert and others.

Validity of Re-issued Patents.

These were three actions at law brought by Battin, for the infringement of a patent granted to him for an improved coal breaker. The patent was originally granted on the 6th of October, 1843. On the 20th of January, 1844, certain improvements made subsequent to the date of the original patent were added to the patent. This patent was afterwards surrendered, and a new one issued on the 4th of Sept. 1849.

The three actions being for similar infringements of the same patent,

were tried together before Judge Kane and a jury in the United States Circuit Court for the Eastern District of Pennsylvania, from the 4th to the 15th of November, 1850. The cases were argued by Messrs. Keller and Dallas for the plaintiff, and by Messrs. Hughes and Mallery for the defendants. A verdict of 800 dollars was found for the plaintiff in each of the three actions.

After the verdict, the defendant filed reasons and moved for a new trial. The motion for new trial was argued before Judge Kane, from the 26th to the 30th of May, 1851, by Messrs. Shepperd and Mallery for the motion, and Messrs Porter, Cadwalader, and Dallas against the motion. Several questions were discussed during the argument, but the motion was disposed of on the ground of the invalidity of the re-issued patent. The positions taken by the respective counsel, are noticed in the opinion of the Court, which was delivered on the 10th of September last, granting the new trial.

The opinion of the Court on defendant's motion for new trial, was delivered September 10, 1851, by Kane J.

The several cases in which Mr. Battin is plaintiff, are before the Court on a motion for new trial. They were tried together, and on the trial, several points of law were reserved by the Judge, and exception was taken by the defendants to his ruling of several others. All of these have been ably reviewed in the present argument. One question, however, determines the motion, and dispenses with the consideration of the rest.

Mr. Battin obtained a patent on the 6th of October, 1843, for a new and useful improvement in the machine for breaking and screening coal, which he defined in his specification as one in which the breaking and screening were effected simultaneously by a set of breaking rollers of a certain form, operating in connexion with an assorting screen. His 'claim' was for the manner in which he had arranged and combined these together.

On the 20th of January, 1844, he described certain improvements which he had made in his machine, and caused them to be included in his patent right. These are not important to the question before us now, but the specification in which they are set out, refers to his original invention as having consisted "in the combining of the breaking and sifting apparatus with each other."

The case of Battin vs. Clayton grew out of an alleged infraction of this patent of 1843; and we held on the trial of it, that the patent being merely for the combination of machinery, it could neither be supported nor assailed by proof of the novelty or want of novelty of the parts. The patent was thereupon surrendered, and a new one issued on the 4th of September, 1849, under an amended specification, which described essentially the same machine as the former one did, but claimed as the thing invented, the breaking apparatus only.

The defendants are using this apparatus, and the jury in the several cases found against them for infractions of the re-issued patent. The damages, though liberal perhaps, do not seem to me excessive; and my own impressions are so strong, of the merits of the invention, that I have very great reluctance in disturbing the verdicts.

But there are two legal positions of a general character which appear to me to bar the plaintiff's right of recovery. They are these:

1. That a description by the applicant for a patent of a machine or a part of a machine in his specification, unaccompanied by notice that he has rights in it as inventor, or that he desires to secure title to it as patentee, is a dedication of it to the public.

2. That such a dedication cannot be revoked, after the machine has passed into public use, either by surrender and re-issue or otherwise.

The first of these propositions will hardly be disputed. If an inventor has a right at all to give up his invention to the world, there is no more unequivocal way of his doing so, than by publishing it on the records of the patent office, and at the same time making no claim to it as his exclusive property. There is no need of a formal disclaimer, where no claim can be implied; and the implication is all the other way, when of several things described, one is claimed without the rest.

The second proposition also seems to be susceptible of easy demonstration. Protection is given to an inventor under the patent laws, as the consideration for his disclosing what was not known before—not as a tribute of civic gratitude for "good deeds past." He loses his right if he allows his invention to become known before he patents it, and when he does patent it, he is required so to describe it at the very outset, that others may not only know how to use it profitably after his patent shall have expired, but be able to distinguish it from other things while his patent is in force.

These are the conditions upon which he is promised the protective intervention of the law for the secure enjoyment of his exclusive property; and they are reasonable ones. He should not be allowed on the one hand to frame his disclosure so indefinitely as to make it practically useless to the community he is contracting with, or to require them to make experiments in order to learn what his meaning was. The law of his contract assumes that his own investigations have defined the character and extent of his invention, as well as its appropriate objects, and its practical usefulness with reference to them, and that he is about to give the fruits of his experience to the world.

Not that he is required to hold back his claim of protection till he has matured or even imagined every modification of his inventive idea. He may describe and claim what he knows, and as he knows it; and leave the office of perfecting it to others. But if he does so, he must not complain that others more scientific, or more ingenious, or more practical, or more patient than himself, come after him to claim property in that which might have been his own, but which he suggested, without appropriating. It may be that his mind is of the higher class, that distinguishes between an isolated, unreasoned fact and the illustration of a principle, and the knowledge which he imparts takes the form therefore of a general instead of a particular truth; and such also may then be the character of his patent. But what he has discovered he must in every case announce and describe, if he asks for it protection as his property. He may not mystify where he cannot teach; he is not to shut out others from the field of invention, except so far as he has occupied it himself and marked its boundaries.

Nor should he be allowed on the other hand, to defer the assertion of

his right, till others have been led by his silence to regard it as waived in their favor, and to make investments of capital, industry, or skill on the faith of such a waiver. The protection of skill, in its broader sense, is the peculiar object of the whole system of patent laws; and it would be specially unjust to the men who represent the skill of community, that they should be invited to elaborate the unclaimed suggestions of a patentee, and be precluded afterwards from using the results of their own invention by finding them embraced in the more general expression of his discovery, as set out in an amended specification—that very expression suggested in its turn perhaps by what they had done and published, or perhaps even patented themselves. The general rule is therefore a just as well as a long established one, that the patentee must stand or fall, according to the assertions of right, that he has made in his application.

The exceptions harmonize in principle with the rule. They apply to those cases, in which there has been formal error, which may be amended of course; or those in which the patentee has by inadvertence described his invention imperfectly, and offers a more accurate description as a consideration of the grant for the amended patent; or those in which, having ignorantly claimed more than he was entitled to, he desires formally to acknowledge his mistake, and renounce the right he had asserted. In the first of these cases, good faith exacts that he be allowed to repair the error; in each of the others, the public is to be a party benefitted by the modification of his patent right.

The Act of 1836 provides therefore, (Sect. 13,) that whenever a patent shall be inoperative or invalid, by reason of a defective or insufficient description or specification, or by reason of the patentee claiming in his specification as his own invention more than he had a right to claim as new, if the error has arisen from accident, inadvertency, or mistake, and without fraudulent or deceptive intention, a new patent may issue to the inventor for the same invention, in accordance with a corrected description and specification for the residue of the unexpired term, or, if the original claim has been so framed that the erroneous part of it may be stricken out without impairing the full and intelligible import of the rest, the patentee may, under the 7th Section of the act of 1837, file a disclaimer, in lieu of an amended specification.

But neither of these sections authorizes a change in the character of the claim—the substitution of a different patentable subject. The defect to be remedied, is either some insufficiency of description or an error in claiming too much. The patentee may make his specification more accurate, or he may restrict the limits of his claim, but a disclaimer cannot expand his right; and his re-issued patent taking the place of the one he has surrendered, must be for the same invention which he sought to patent from the first.

Were the law otherwise, it would be a perilous thing to admit of improvements in the machinery and processes of our workshops. There would be no knowing what was patented and what public; an inventor would have only to amplify his description and illustrate it well by drawings and models, postponing his claim to some part or other of it until it had passed into use, to be secure of many perfectly legitimate rights of action, for discussion afterwards in the Courts, or more profitable adjustment by compromise.

It is no answer to this, that such a course would be fraudulent; for how is such a fraud to be detected? Can the Commissioner refuse an amendment which comes to him supported by the patentee's oath, and altogether in harmony with the description, drawings, and models that accompanied his first application. Where is the proof to come from, of a "deceptive intention" on his part?

Nor is it an answer to say that, according to the 13th Section of the Act of 1836, the amended specification is to be without operation or effect, except "on the trial of actions for causes accruing subsequently." The process newly claimed may have required a large preparatory outlay, expensive buildings, peculiar machinery, large purchases of material, widely extended contracts, and the special education of skill. To apply these to their proposed use, or to continue applying them, after the specification has been amended, will constitute a "cause of action subsequently accruing," which the law will give damages for, and equity interpose to prevent. It costs some thousands of dollars to erect a machine like the defendant's, and it is valueless to him if he is not allowed to use it.

I hope that I shall not be understood as animadverting on the plantiff, in these remarks. His conduct appears to have been entirely fair, and I am truly sorry that he fails of the protection he has sought, for the want of a specification, properly drawn in the first instance. The discussion is of a principle, not of an individual case.

Nor does it really involve a question of good faith. Public policy, the safety of all who are watching the advance of art, and availing themselves of it, for the purposes of practical use, the intelligent and enterprising artificers of progress, the thinking mechanic, who labors to improve upon what is known to make things better than he finds them, the capitalist who rewards skill and labor while he shares their earnings, and the entire community, made richer, happier, wiser, and better, by the results of judiciously directed industry—all demand that a clear and definite line shall distinguish between that which is prohibited and that which is free; a line not to be varied capriciously or without full previous notice, nor with the changing opinions of individuals as to the character and extent of their exclusive interest, nor to the prejudice of any vested interest of the many.

Mr. Battin's invention, as he now defines it, was in use for nearly six years before he claimed that it was his property. He had made it known as an unprotected element of the combination he patented in 1843. It was not till 1849 that he asserted any other right in it for himself than he conceded to every body else. He cannot reclaim what he has thus given to the public.

Per Curiam. New trial granted.

MECHANICS, PHYSICS, AND CHEMISTRY.

*The Marine Steam Force of Great Britain.**

Great Britain possesses one hundred and forty-seven steam-ships, including three in Canada, and thirty-two iron steamers, eleven ranging from 1547 to 1980 tons. Of these, four were formerly 76-gun ships, and

* From the Glasgow Practical Mechanic's Journal, for August, 1851.

have now engines of 450 horse power. The largest, the Simoom, of 1980, has only 350 horse power; the Terrible, however, of 1850, has engines of 800 horse power; the Termagant, of 1547, has engines of 620 horse power; while the Arrogant, of 1872, has only 360 horse power; the Retribution, of 1641, has 400 horse power. One of the above eleven, the Penelope, was a 46-gun frigate. Fifteen from above 1200 and under 1500 tons, twenty-seven above 1000 and under 1200, twenty-three above 700 and under 1000, nine above 500 and under 700, twenty-seven from 250 and under 500, twenty-two from 150 and under 250, four from 42 to 149; three on the lakes of Canada, one of 406 and of 90 horse power, and one of 750 and of 200 horse power; twelve packets, 237 to 720, some of which are very fine vessels; 58,643 in commission, and 58,501 tons in ordinary. Of the steamships there are built of iron—the Simoom, 1984; the Vulture, 1764, both 350 horse power; the Greenock, 1418, and 550 horse power; the Birkenhead, 1405 and 556 horse power; the Niagara, 1395, and 350 horse power; the Trident, 850, and 350 horse power; the Antelope, 650, and 264 horse power; the packet Lizard, 340, and 150 horse power; the Bloodhound, 378, and 150 horse power; the Grappler, 557, and 220 horse power; the Sharpshooter, 503, and 202 horse power; the Harpy, 344, and 200 horse power; the Myrmidon, about 350, and 180 horse power, the Sphynx and Fairy, about 300, and 110 horse power; and four other smaller vessels of 20 to 9 horse power. Six of the packets are built of iron. Screw steamers on the stocks, viz., one 80-gun at Devonport, one 80-gun at Woolwich, and one 80-gun at Pembroke; in all, one hundred and fifty steamships. Then there is the mercantile steam power. The steam vessels registered in the port of London on the 1st of January, 1851, was three hundred and thirty-three: one hundred and seventeen under 100 tons, sixty-four from 100 to 200, twenty-six from 200 to 250, twenty-seven from 250 to 300, sixteen from 300 to 350, nine from 350 to 400, ten from 400 to 450, eight from 450 to 500, three from 500 to 550, seven from 550 to 600, three from 600 to 650, six from 650 to 700, two from 700 to 750, five from 750 to 800, three from 850 to 900, one from 900 to 950, eight from 1000 to 1500, six from 1500 to 1800, eleven from 1800 to 2000, and one above 2000 tons. In Liverpool there were ninety-two steam vessels: twenty under 100 tons, forty-nine from 100 to 200, twelve from 200 to 400, six from 400 to 600, three from 600 to 800, one of 1300 tons, and one of 1609 tons. At Bristol there were thirty-one steam vessels: eleven under 100 tons, fourteen above 100 tons and under 300, three from 300 to 500, two from 500 to 600, one (Great Britain) of 2936. At Hull there were thirty-four steam vessels: eight under 100 tons, seven from 100 to 200 tons, eight from 200 to 400, eight from 400 to 700, two from 700 to 1000, and one of 1320 tons. At Shields there were fifty steam vessels: forty-eight under 100 tons, one of 388, and one of 106 tons. At Sunderland there were thirty-two steam vessels under 100 tons. At Newcastle-upon-Tyne there were one hundred and thirty-eight steam vessels: one hundred and thirty under 100 tons, six from 100 to 300, two from 300 to 500. At Southampton there were twenty-three steam vessels: nine under 100 tons, nine from 100 to 300, five from 300 to 500. At Glasgow there were eighty-eight

steam vessels: fourteen under 100 tons, forty-eight from 100 to 300, sixteen from 300 to 700, three from 700 to 1000, five from 1000 to 2000, two from 2000 to 2500. At Leith there were twenty-three steam vessels: eight under 100 tons, twelve from 100 to 500 tons, three from 500 to 1000 tons. At Aberdeen there were sixteen steam vessels: three under 100 tons, four from 100 to 300, three from 300 to 600, five from 600 to 1000, and one of 1117 tons. At Dublin there were forty-four steam vessels: three under 100 tons, fifteen from 100 to 300, thirteen from 300 to 500, thirteen from 500 to 800. At Dundee there were ten steam vessels: five under 100 tons, two from 100 to 200, three from 500 to 800. At other ports there were two hundred and seventy steam vessels: one hundred and thirty-nine under 100 tons, sixty-one above 100 and under 250, forty-five from 250 to 500, twenty-two from 500 to 750, and three from 750 to 1000.

"A Description of a New Metallic Manometer, and other Instruments for Measuring Pressures and Temperatures." *By* M. Eugene Bourdon, *of Paris.**

In the course of manufacturing a coiled copper worm for a still, one side becoming flattened by accident, internal pressure by a force pump was applied, to restore the cylindrical form, and to the astonishment of the author, as the pressure increased, the coiled tube unwound itself. This induced further experiments, which resulted in the production of the various instruments described in the paper, an engraving of one of which will be found at page 164.†

The transverse section of the coil was that of a flattened tube, which when acted upon internally by the pressure of steam, or any other fluid, had a tendency to uncoil itself, as the density increased, and to return to its original form, on the pressure being removed. If it was exposed to external pressure, or a partial vacuum was created within it, the tendency of the tube was to coil itself up into a smaller diameter. In the former case, as the tube uncoiled itself, its sides became more convex, and its capacity became greater; and, in the latter instance, the capacity diminished as the sides collapsed and approached each other. It was on this relation between the capacity of the tube, or the amount of convexity of the sides, and the diameter of the coil, that the action of the instrument depended. If a flat band of metal was bent round a circle, its transverse form remained unaltered, but if a semi-cylindrical or gutter-shaped band, was bent into a circular coil, its convexity was diminished; and if the circle formed by it was of small diameter, the band became almost flat in the transverse direction. It being then a law of general application, that a surface which was curved in two directions could not have its curvature increased in one direction, without its curvature being diminished in the other direction, and vice versa, the action of the instruments in measuring pressure or temperature was easily understood.

The variation in the thickness, or capacity of a curved flattened tube, was shown by filling the tube with a liquid, and attaching to the centre of its external periphery, a small glass tube; when every change of cur-

* From the London Artizan for December, 1851.

† For description and illustration see Jour. Frank. Inst., Vol. xxii, p. 234.

vature produced a corresponding motion in the liquid in the tube; for as the tube was straightened its capacity increased, and as it curled up again it diminished.

The change in the thickness or capacity of the tube being proportional to the variation of its radius of curvature, it was found by experiment, that the motion of the extremities of the tube was in proportion to the pressure applied, so that the indications were equal for equal increments of pressure; this fact greatly facilitated the construction of the indicating instruments.

The simplest form exhibited was that of the steam pressure gauge, in which rather more than one convolution of flattened tube was employed; one end being attached to a stop cock, in connexion with the boiler, and the other extremity carrying an index pointer, which traversed a scale graduated to given pressures per square inch; on the steam being admitted, the tube uncoiled, and the pointer indicated the amount of pressure to which it was subjected. It is obvious that by attaching a pencil to the end of the pointer, and providing the ordinary apparatus for carrying the paper, the instrument is converted into a steam engine indicator.

When a greater range of motion was required, the lever, instead of being placed on the axis of the index, carried a toothed segment, which, working into a pinion on the spindle of the index, increased the extent of indication. This arrangement was adapted for barometers, in the construction of which the air was exhausted from the flattened tube, which was then hermetically sealed. The pressure of the atmosphere acted on the exterior, and was balanced by the elasticity of the tube, which varied in curvature with every variation in the pressure of the atmosphere.

In barometers, the tube is usually fixed at the centre, the ends being left free to move, and being connected to the ends of a lever. For marine barometers, balance weights are also provided, to counteract the weights of the ends of the tube, which would affect its accuracy, when the instrument was inclined from the perpendicular. Thermometers are constructed by filling the tube with spirits of wine, and a pirometer, for measuring high temperatures, can be formed by attaching to the instrument a platinum ball, full of air, the expansion of which, when acted upon, indicates the temperature.

The author has even constructed a model steam engine on this principle, which was exhibited at the Great Exhibition. This consisted of a steel tube, of horse-shoe shape, one end of which was fixed, whilst to the other was attached a connecting rod, taking on to a crank in the ordinary manner. An eccentric on the crank shaft moved a slide on the fixed end, to regulate the admission of the steam, and to avoid refilling the whole tube at every stroke, the tube was filled with oil. The pressure of the steam effected the one stroke, and the elasticity of the tube the other.

Mr. Brunell stated that he had tested one of Mr. Bourdon's barometers, and found it very accurate and sensitive. The heights of the floors in a house might be observed, as well as the gradients the experimenter passed over in a cab, or on a railway. In using the steam-gauge, it was necessary to avoid allowing it to become heated by the steam, which might be done by interposing a syphon, which would fill with water, and also by immersing the syphon in cold water.

It was suggested that a modification of the instrument might be used as a deep sea lead, the depth being indicated by the pressure, and the instrument being made self-registering.

The instruments were stated to be very generally adopted in France, where the government inspectors of steam engines used pressure gauges on this principle, in verifying the accuracy of all the other instruments they found attached to the engines under their inspection. At the French Exposition of 1849, M. Bourdon received a gold medal, and at the Great Exhibition in Hyde Park, he was rewarded by a Council medal.—*Proc. Inst. Civ. Eng., Nov. 18th*, 1851.

For the Journal of the Franklin Institute.

A Series of Lectures on the Telegraph, delivered before the Franklin Institute. Session, 1850–51. *By* Dr. L. Turnbull.

Continued from page 63.

Edward Davy's Telegraph.

The next telegraph in chronological order is that of Mr. Edward Davy, of London. The patent for this telegraph was sealed July, 1838, and published in the *Repertory of Patent Inventions*, London, July, 1839. The specifications are very voluminous, and not very intelligible. I have therefore studied it carefully, and have given the important points, and a drawing, which fully illustrates the improvements which Davy proposed, being careful not to omit any vital part of his machine. In this method of treating it, I have followed the examples of Moigno and Shellen, two of the latest writers upon the subject of the history of the telegraph.

In the telegraph of Edward Davy, the decomposing action of the galvanic current is employed to produce marks upon chemically prepared cloth, or other material; the cloth preferred by the inventor was *calico*, and the chemical substance employed by him to prepare the cloth was a solution of the iodide of potassium and muriate of lime.

He employed a local battery to produce the telegraphic signs by chemical decomposition. This battery also operated an electro-magnet, whose armature regulated the movement of the registering instrument. This battery is also connected with a short independent circuit, which is closed and opened by the movement of a magnetic needle, surrounded by a coil of copper wire, which forms part of the main circuit. He employed finger-keys to open and close the circuit; his receiving instrument being similar in principle to Cook and Wheatstone's, only closing his circuit like Mr. Morse, by the contact of solid metals, instead of mercury. When the main circuit is closed by the finger-keys, the needle is deflected which closes the short circuit; but when the main current is interrupted, the needle opens the short circuit by returning to its original position.

The cloth or other chemically prepared material is drawn between a metallic cylinder and a series of platinum rings surrounding a wooden cylinder; by these rings the current from a local battery is passed through the chemically prepared cloth to the metallic cylinder beneath, producing signs consisting of simple dashes arranged in six rows. The calico is

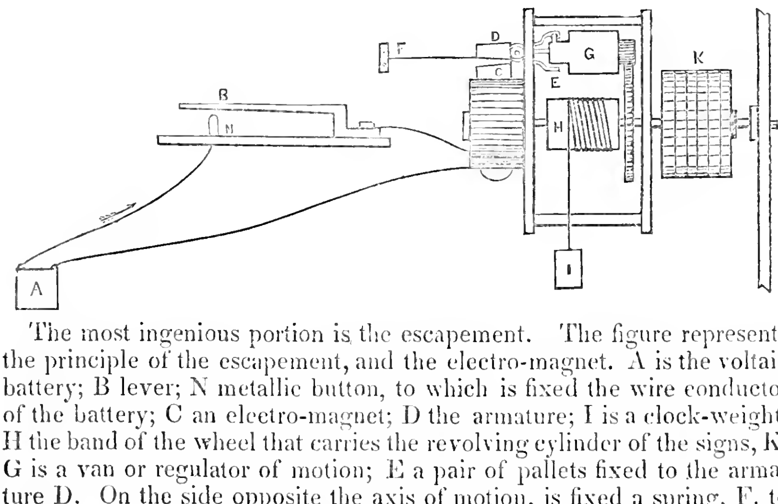
moved by clock-work, and this clock-work is regulated by a U electro-magnet, with an armature and lever, which at each motion withdraws the stop from a fly-wheel for the space of a semi-revolution, during which a single sign is made upon the calico, the clock-work moving always in proportion to the number of signs transmitted. The platinum rings were so arranged as to be connected separately or together, at will, with the other poles of the battery, but insulated from each other.

In his patent three telegraphic wires are represented, which are made by means of his commutator to connect a local circuit with either of the six platinum rings, so as to simplify the system of marking necessary to form the signs for the different letters of the alphabet.

There cannot be a doubt that Davy was informed of the telegraphs of Morse and Steinheil, by the following remarks at page 12 of his Specifications:

"I am aware that it has been proposed to use a marking instrument with lead or ink, by the aid of an electro-magnet, to make a number of dots or marks in immediate succession, to indicate the signification of such communication; I do not, therefore, claim the use of marking instruments generally, but only when they are adapted to make communications by marks across and lengthwise of the fabric which receives them, as above described."

Fig. 42.



The most ingenious portion is the escapement. The figure represents the principle of the escapement, and the electro-magnet. A is the voltaic battery; B lever; N metallic button, to which is fixed the wire conductor of the battery; C an electro-magnet; D the armature; I is a clock-weight; H the band of the wheel that carries the revolving cylinder of the signs, K; G is a van or regulator of motion; E a pair of pallets fixed to the armature D. On the side opposite the axis of motion, is fixed a spring, F, to separate the armature from the electro-magnet, by which the electric current is broken, and magnetism destroyed. The arrangement is such that for every revolution of the van G, the cylinder K advances one division, and a letter is impressed. If the lever B rests against the metallic button N, the metallic circuit of the voltaic battery is immediately established, the electric current passes along the conducting wires of the electro-magnet C, which instantly attracts the armature D, forces the superior pallet E to abandon the lever O, and permits the van to turn. As soon as it turns half a revolution, it is arrested by the inferior pallet, against which the lever touches. The contact of this lever, being aban-

doned, the voltaic circuit is instantly broken, magnetism destroyed, and the spring F leaves the armature in its first position. This movement lowers the inferior pallet, sets at liberty the lever O, and the second half of a revolution is performed, bringing it into a new position, and arrests it against lever O, or superior pallet. For each complete revolution, a character successively appears. The operation of successively elevating and depressing the key, gives the cylinder of signs a circular motion, in the same manner that the hand of a clock is made to revolve by means of balancing and escapement. On some cotton fabric are some longitudinal lines, intersected by transverse ones, dividing the surface into little squares. It is impregnated with iodide of potassium and chloride of lime, and wound on a cylinder that turns by a weight at each magnetic pulsation. The current traverses this prepared material, and leaves a well marked trace in the square indicated by the touch of the director. The position of the square in the net-work marked on the stuff, determines the letter or signal. This mode requires seven or eight lines, and has never been put in practical operation, though patented in January, 1839.

The following are the claims in full, as given in the original publication:

"First, The mode of obtaining suitable metallic circuits for transmitting communications or signals by electric currents, by means of two or more wires, which I have called signal-wires, communicating with a common communicating-wire, and each of the signal-wires having a separate battery, and, if desired, additional batteries, for giving a preponderance of electric currents through the common communicating-wire, as above described.

"Secondly, I claim the employment of suitably prepared fabrics for receiving marks by the action of electric currents for recording telegraphic signals, signs, or communications, whether the same be used with the apparatus above described or otherwise.

"Thirdly, I claim the mode of receiving signs or marks in rows across and lengthwise of the fabric, as herein described.

"Fourthly, I claim the mode of making telegraphic signals or communications from one distant place to another, by the employment of relays of metallic circuits, brought into operation by electric currents.

"Fifthly, The adapting and arranging of metallic circuits in making telegraphic communications or signals, by electric currents, in such manner, that the person making the communication shall by electric currents and suitable apparatus, regulate or determine the place to which the signals or communications shall be conveyed.

"Sixthly, I claim the mode of constructing the apparatus which I have called the escapement, whether it be applied in the manner shown, or for other purposes, where electric currents are used for communicating from one place to another.

"Seventhly, I claim the mode of constructing the galvanometer herein described.

"And lastly, I claim such parts as I have herein pointed out, as being useful for other purposes, as above described."—[*Repertory of Patent Inventions, July,* 1839.

Bain's Printing Telegraph.

The following extract of a letter is taken from a work, entitled "An

Account of some remarkable applications of the Electric Fluid to the Useful Arts: by Alexander Bain: edited by John Finlaison, Esq. London, 1843," which gives us the date of Mr. Bain's first telegraph:

"*Percival Street, Clerkenwell, Aug.* 28, 1842.

"Dear Sir:—I recollect visiting you early in June, 1840, when you showed me a model of your electro-magnetic telegraph.

"ROBERT C. PINKERTON."

In July, 1841, it was exhibited and lectured on at the Polytechnic Institution, London. It consists of three principal parts.

1st, The rotary motion given to the type wheel, step by step motion, like the second-hand of a clock, until the required letter arrives opposite the paper.

2d, The means of inking the types, or otherwise making permanent the imprint of the types upon the paper.

3d, The motion communicated to the paper, so as to bring a fresh surface under the types, and receive the printed intelligence in a continuous spiral line, until the book is filled.

He uses wire coils freely, suspended on centres, for electro-magnets. These coils, within and in the vicinity of which are fixed powerful permanent magnets, are deflected as long as the electrical current is passing through them; but when the electric current is broken, they are drawn upwards by the force of the spiral springs, the levers are released, and the machinery of the telegraph, worked by main springs, are left free to rotate. The only battery proposed by Mr. Bain is a pair of copper and zinc plates, one of which is to be buried in the earth at one station, and the other at the distant station, where there is to be a telegraph the exact counterpart of the first.

I have considered it entirely unnecessary to give a drawing of this telegraph, as it never could be of very great service; and as to the form of battery, it was entirely out of the question. The best evidence of this was, that an entire change was made in it by Mr. Bain in 1846, a description and drawing of which will be found in my article on Galvanic or Electro-Chemical Telegraphs.

I find in the same work the following account of some interesting experiments on the earth as a source of permanent voltaic electricity:

"In prosecuting some experiments with an electro-magnetic sounding apparatus, in the year 1841, it was found that if the conducting wires were not perfectly insulated from the water in which they were immersed, the attractive power of the electro-magnet did not entirely cease where the circuit was broken. For the purpose of investigating the nature of this phenomenon, a series of experiments took place, with great lengths of wire, in the reservoir of water at the Polytechnic Institution, when similar results were obtained. While reflecting upon these experiments, some few months after they had been performed, Mr. Bain was led to infer, that if a surface of positive metal was attached to one end of a conducting wire, and an equal surface of negative metal to the other end, and the two metallic surfaces put into water, or into the moist earth, (the wire being properly insulated,) an electric current would be established in the wire."

This proposition was soon tested by experiment. A surface of zinc was buried in the moist earth, in Hyde Park, and at rather more than a mile distance a copper surface was similarly deposited; the two metals were connected by a wire suspended on the railing, and on placing a galvanometer in the circuit, an electric current was produced, which passed through the intervening mass of earth from one plate to the other, and returned by the wire. In the first expĕriment, the metallic surfaces being small, the electric current produced was feeble; but on using a large surface of metal, a corresponding increase in the energy of the current was obtained, with which an electrotype process was conducted, and various electro-magnetic experiments performed with universal success.

It is essential to success, that the earth wherein the plates of metal are deposited should be of a moist nature. A current has indeed been obtained in dry soil, but of such small energy as to be of no practical utility.

A patent was solicited for the application of this mode of producing electric currents to his printing telegraph, and obtained in April, 1841.

This form of battery could never have been of any useful application to great distances, without an increase of the number of plates and of the exciting fluid.

Sturgeon's Electro-Magnetic Telegraph.

In the *Annals of Electricity* for October, 1840, is published a description and drawings of a form of electro-magnetic telegraph, proposed by William Sturgeon, of London, a man who has by his numerous experiments and researches into the subject of electricity and magnetism, conferred signal benefits on these important sciences, and has not received the full award of merit even from his own countrymen. The publication of the *Annals of Electricity* alone deserves the thanks of all interested in these important subjects, containing as they do a mass of valuable in ormation not to be found elsewhere in our language.

"In describing a new electro-magnetic telegraph, I am necessarily impelled by a similar feeling to that which urged my predecessors to bring their respective inventions before the public; and I cannot resist the idea that there will be found a peculiar simplicity both in the structure and management of the telegraph I am about to describe. Indeed, I shall point out the structure of two distinct telegraphs, having the sign common to both. Also, a third, differing very materially from the other two.

"In one of these telegraphs I use six soft iron bars, bent into the form of horse-shoe magnets, and covered with copper wire spirals, in the usual way, for converting them into occasional magnets by electric currents. To each magnet is a short bar of soft iron for a keeper or cross-piece, which is attached to the shorter arm of a lever, of the first order; and to the extremity of the longer arm of the lever is attached a circular card. The arrangement of one of these pieces of apparatus is shown by figs. 44 and 45, the former being a side view, and the latter an end view of it: *m*, in both figures, represents the magnet, *i* the cross-piece, *a b* the lever, and *f* the fulcrum. The cards at the longer extremities of the six levers are numbered 1, 2, 3, 4, 5, 6, which, individually, and by a series of simple combinations, form all the signals that are required.

"When the levers are in the position shown in figs. 44 and 45, the

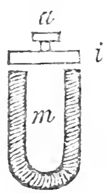
magnet is out of action, in consequence of the battery circuit being interrupted. If, now, the battery circuit were to be closed, the magnet *m* would immediately be brought into action, and its attractive force would bring down the cross-piece *i*; which, being attached to the shorter arm of the lever, would raise the longer arm with its card and sign, into the position of the upper dotted circle, where it becomes visible through a circular opening in the face of the instrument, as at (5) in fig. 43. When that particular sign has appeared the required time to be observed, the battery circuit is opened, the magnet *m* loses its power, and the longer arm of the lever preponderating, again falls down to its first position, and the card with its sign disappears.

Fig. 43.

1 = *a*	12 = *h*	23 = *n*	34 = *r*	45 = *u*	56 = *x*
2 = *b*	13 = *i*	24 = *o*	35 = *s*	46 = *w*	
3 = *d*	14 = *k*	25 = *p*	36 = *t*		
4 = *e*	15 = *l*	26 = *q*			
5 = *f*	16 = *m*				
6 = *g*					

Fig. 44.

Fig. 45.



"The face or dial of the telegraph is represented by fig. 43, which may be either of painted wood or metal, silvered in the manner of clock faces, or barometer scales. On the upper part of the dial there are six circular openings, for the occasional appearance of the cards, with their figures, which are attached to the longer arms of the six levers. (See fig. 44.) Below the circular openings in the dials plate there are arranged the signals which are to represent all the alphabetical letters that are necessary for the spelling of words. The signals are thus continually before the eyes of the operator, and are too simple to miss being understood. These levers, with their magnets, &c., figs. 44 and 45, are placed behind the dial in a suitable case, and in such a manner that the figures on the cards may appear at the circular openings whenever their levers move upwards by the attractions of their respective magnets at the other, or shorter arms; and to disappear below those circular openings, when the magnets are out of action. To accomplish this latter effect, the face of the cross-piece of iron, which is attached to the short arm of each lever, must be covered by a card, or a film of some non-ferruginous matter, which will prevent close contact of the iron and magnet. By this arrangement of the apparatus, it is a matter of no consequence in what way the magnetic poles are arranged, because the attraction of the cross-pieces, attached to

the shorter arms of the levers, will take place as well with one arrangement as with another. But for uniformity, we will suppose that the coils on the magnets are all of the same kind, and that the north poles are to be in one and the same direction, towards the left hand for instance, to a person facing them, then those extremities of all the coil wires which were situated in one direction, might be collected together in one bundle, and either continued to the station where the battery is situated, or soldered to one stout copper conductor, at some short distance from the magnets, which conductor would become a general *fixed channel* between all the magnets at this station, and the battery at the other station. The other six ends of coil wires must be insulated by silk covering, and continued to the battery without metallic contact with each other. At the battery station these six insulated wires are to be attached to six wooden or ivory keys with springs, like the keys and springs of a piano forte; by the downward motion of which, the extremities of the wires become immersed in a long trough of mercury, connected with the opposite pole of the battery to that which the other conductor is attached to. On the top of each key is to be a conspicuous figure, corresponding to the figure which is to appear in the dial plate at the other station, so that when one finger is placed on key 2, and another finger on key 5, the magnets 2 and 5 at the other station are brought into play, and by attracting their respective pieces of iron, the figures 2 and 5 make their appearance on the dial as seen in fig. 43, and the letter p is understood. By these means, twenty-one of the letters of the alphabet can easily be represented without a possibility of error, either in the manipulation at the one station, or in the reading at the other; unless, indeed, there be a deficiency of attention which would incapacitate the attendants for employment at any telegraph whatever.

"The keys of this telegraph are sufficiently near to each other to permit the fingers to press on any number of them at one time, and, if necessary, the whole of the magnets may be brought into play at once, by the application of three fingers of each hand to the keys. By these means, the numerals may be grouped into combinations of three, four, five, and six, and thus, without the slightest confusion, a considerable number of signals would be obtained, which might represent words, or whole sentences, which would greatly expedite the transmission of intelligence from one end of the line to the other.

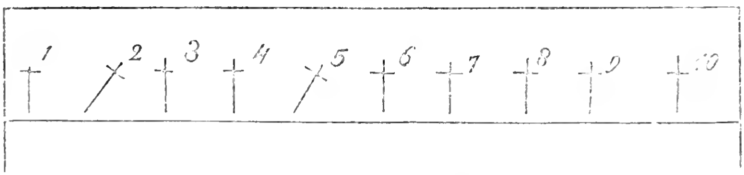
"There is a very great advantage in employing the numerals for signals. Not only because they are not so liable to lead to confusion as by the employment of the alphabetical letters, when used in combinations or groups; but because the subject of communication may be kept a perfect secret from one end of the line to the other; which is a most essential consideration in government expresses, and very often in those of mercantile affairs also.

"In this telegraph a seventh magnet is employed to ring a warning bell, as first proposed by Professor Steinheil.

"Although in the telegraph already described I employ soft iron magnets and levers to bring the signals into view, I am of opinion that magnetic needles in coiled conductors, or electro-magnetic multipliers, will be somewhat more prompt in their motions than the lever, at great dis-

tances from the battery. I therefore propose to make the necessary signals by means of magnetic needles, which can be moved with the same arrangement of conductors as that already described. And although I have only used six numerals for the signals, I am very far from supposing that the working of an electro-magnetic telegraph is facilitated or simplified by using a small number of original signals, or by having a small number of conductors. The simplest method of *spelling* words would be to have a needle for each letter of the alphabet, and the telegraph could be *made* and *worked* as easily by 24 needles as by a smaller number. And the words and sentences, which could be signified by combining them in pairs, or in groups of two each, would afford great facilities for the rapid transmission of ideas from one end of the line to the other. The needles could be placed in three horizontal rows, one above another, on a vertical dial plate.

Fig. 46.



"I have shown a dial plate in fig. 46, on which are placed 10 needles, with their respective figures or signs. As the needles can be deflected in only one direction, viz., with the north end towards the figure which belongs to it, there can be no mistake in understanding what sign is to be understood. I believe that any of these telegraphs will be found much simpler than those already before the public. They are capable of producing many more signs than any other known, and may be made at a less expense."

To be Continued.

For the Journal of the Franklin Institute.

English and American Propellers for Atlantic Navigation.

The success attending the *City of Glasgow* and *Manchester*, running to this port, and the *Glasgow* to New York, all English vessels, has led many, myself among the number, to be very much surprised at the partial failure, at least, of the *S. S. Lewis*, running to Boston, the *Pioneer*, to New York, and the *City of Pittsburgh*, to this port. And it has occurred to me that the great height of our American propellers above the water, and the consequent instability caused thereby, together with their very heavy rig, will account for the whole difference; for example, the *City of Manchester* is 274 feet long, 37¾ feet beam, and 31 feet hold, with an average draft of water of about 18 feet; while the *City of Pittsburgh* is 245 feet long, 38 feet beam, and 33 feet hold, with heavy houses on deck in addition, and to this must be added about 1½ feet as the difference of thickness of the bottom between wood and iron; her average

draft is 20 feet; it is very evident from this, that the section of the *Pittsburgh* above and below water is the greatest, which, combined with her heavy rig, must, during the prevalence of the strong westerly winds of winter, give the latter a decided advantage. The English custom, looking at the points and dimensions of their propeller ships, is to make them as low as is consistent with comfort and safety, and to obtain capacity by length. Which is right? Will some one answer? X.

For the Journal of the Franklin Institute.

Ship Building in New York for 1851.

The following is the number of vessels finished and remaining on the stocks in New York, at the close of the year 1851:

	Finished.	Unfinished.	Total.
Clipper Ships, ...	15	3	18
Ships, ...	7	1	8
Steamships and Propellers, . .	17	5	22
Steamboats, ...	20	6	26
Barks and Brigs, ...	3	1	4
Pilot Boats and Schooners, . .	21	7	28

Total, 106 vessels of all classes, whose aggregate tonnage is equal to 80,761 tons. Of the 22 vessels under the head of steamships and propellers, 17 are side wheel steamers.

The total number of side wheel sea-going steamers built up to this date is 53.

Hints on the Principles which should regulate the Forms of Boats and Ships; derived from original Experiments. By Mr. William Bland, *of Sittingbourne, Kent.**

Introduction.

As much difference of opinion has prevailed of late years respecting the true forms of ships, I have been induced to make a series of experiments with models of wood, to ascertain, by a careful noting of results, what are the governing laws. And I flatter myself I have been successful, in some measure, in detecting a few of the principles which influence the speed, the stability, and the safety of vessels impelled forward by the wind, the oar, and steam.

Chapter I.

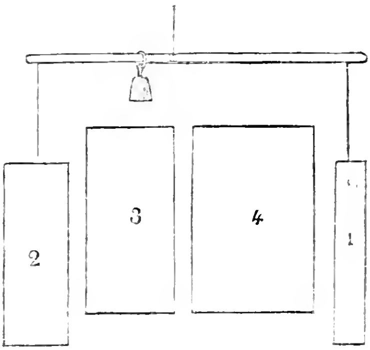
This chapter contains the particulars of experiments undertaken to gain a knowledge of the laws of water with regard to the head resistance it makes against bodies floating upon its surface, and impelled forward by some force, as the wind, the oar, and steam.

* From the London Architect, for September, 1851.

To this end, four pieces of deal were selected, of the same uniform density and thickness, and each 12 inches long, but varying in width.

No. 1 model, 2 inches wide and 12 inches long.
No. 2 model, 4 inches wide and 12 inches long.
No. 3 model, 6 inches wide and 12 inches long.
No. 4 model, 8 inches wide and 12 inches long.

These were, two at a time, attached by strings to the two ends of a balance-rod, of the length of $20\frac{1}{2}$ inches; a third string, acting the part of a fulcrum whilst suspending the rod, was so put on the rod as to admit of being readily slipped along at the will of the experimenter; the other end being fastened to the small extremity of a long pole, for the purpose of reaching far enough over a pond of water to tow the models upon the surface, clear of all obstacles.



The Balance Rod.—Scale One-Twelfth.

The two models selected for experiment were then drawn on the water, and whichever of them preponderated, by meeting with greater resistance than the other, had the suspending-string shifted along the balance-rod until both the floating bodies attained an equilibrium of resistance, when the measure of their respective resistances was denoted by the inverse length of the arm or lever to which they were fastened. The shorter arm was made, in each experiment, to balance correctly the longer arm, by the means of a movable weight applied to the shorter arm.

Experiment 1.

Models.	Width.	Length.	Weight.	Difference.	Weight.
No. 1.	2 in.	12 in.	10 oz.	$1\frac{1}{8}$-inch of lever, or	2 oz.
No. 2.	4 in.	12 in.	10 oz.		

Experiment 2.

No. 2.	4 in.	12 in.	$12\frac{3}{4}$ oz.	$1\frac{1}{8}$-inch of lever, or	2 oz.
No. 3.	6 in.	12 in.	$12\frac{3}{4}$ oz.		

Experiment 3.

No. 3.	6 in.	12 in.	19 oz.	$1\frac{1}{8}$-inch of lever, or	2 oz.
No. 4.	8 in.	12 in.	19 oz.		

In these experiments the dimensions of the models were to each other

as 1, 2, 3, and 4; and the head resistance, compared two at a time, and of equal weight, gave the same results; consequently, the law of the head resistance is, that it increases directly with the increase of the square surface opposed; and therefore in this instance of equal additions, assumes the arithmetic ratio.

Chapter II.—Experiments made to ascertain the Law of the Resistance of Water against the Increase of Weight.

Experiment 4.—For this purpose, two model boats were selected of equal draft, and into one was put a 1 lb. weight; and being drawn on the water by the same balancing-rod which was employed in the preceding chapter, and the difference of the resistance determined as before, the law revealed itself thus:—

With 1 lb.	weight, the	short arm was	$7\frac{1}{2}$	inches long.
With 2 lb.	"	"	$6\frac{1}{2}$	"
With 3 lb.	"	"	$5\frac{1}{2}$	"

That is to say, the resistance increases directly with the weight.

Chapter III.—Of Lateral Resistance.

A ship impelled through the water by wind acting on its sails, depends for speed in no small degree upon the lateral resistance it makes, and the situation of the centre of that resistance.

The following experiments were undertaken to ascertain the law, and how influenced.

Experiment 5.—First, around and near the midship section of a model ship, was fastened, yet readily movable, one end of a line; the other end left to be taken in hand, a sufficient quantity of line being allowed between to tow the vessel through the water towards the shore, when placed at some distance from the same.

And second, the model put on the water was repeatedly drawn to the shore, and the point of fastening of the line as frequently shifted. The effects were these:

When the point of fastening was situated a trifle towards the head, the line on being pulled drew the head forward; and when fixed rather astern, then the stern was drawn forward; thus proving, there existed a point or centre of balance. By carefully moving the place of fastening, it was readily found, upon measurement, to be situated exactly in the mid-length of the keel and part of the projecting cutwater, the vessel floating upon a level keel.

During the carrying out of the above investigations, it was observed, that when the vessel was made by the line to progress forwards, as well as sideways, the centre of lateral resistance moved also forwards; and this, of course, was in consequence of its bows meeting with greater resistance than when moved exactly sideways.

The reason is obvious; first, because the water at the bows became condensed, and thus made greater resistance; and second, on account of the water being driven up against the bows, higher than the surrounding fluid, produced its effect.

The above named resistance equalled, it was found, about one-twelfth

of the length of the body immersed; but which proportion must vary, however, with the speed.

The centre of gravity in all these experiments seemed to have little or no influence with regard to the centre of lateral resistance, it being regulated by the perpendicular surface exposed to the water; and the centre of which was the centre of lateral resistance when the force of the water acted at right angles to that surface.

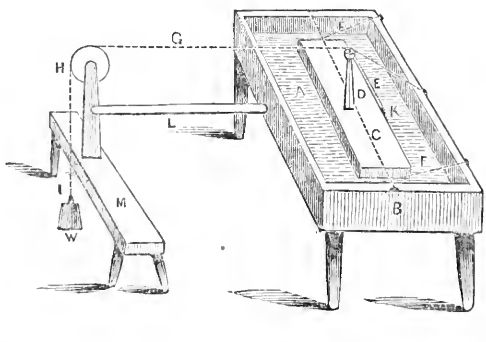
Chapter IV.—Of Stability and its Laws.

Experiments relative to the Law of Stability when the Width or Beam is increased.

For this purpose four pieces of deal were chosen, of the following dimensions:—

No.	Length.	Width.	Depth.	Weight.
1	15 in.	3 in.	2 in.	1 lb. 8 oz.
2	15 in.	$4\frac{1}{2}$ in.	2 in.	2 lb. 3 oz.
3	15 in.	6 in.	2 in.	2 lb. 13 oz.
4	15 in.	$7\frac{1}{2}$ in.	2 in.	3 lb. 7 oz.

In order to ascertain the stability of each respectively, as they in turn floated upon the water, a small movable mast, three inches high, having a hole through the top, was fixed on the upper surface, and in the centre of gravity; one end of a line was looped over a nail driven into the side of the wood, when the other end was first passed through the hole, then continued on over a pulley, and at the end a small bag was attached for the convenience of holding weights. Into the two extremities of the same piece of wood as No. 1, nails were driven lightly, and at the points where the centres of the wood cut the line of flotation. Over the heads of these nails a string of sufficient length was secured by two loops, the other ends of the strings being then made fast to nails driven into the side of the cistern of water, and at the water-level; but in the direction opposite to the string going over the pulley, with the view of counteracting the force of the weights.



A B the tank, and A, the surface of the water; C, the model; D, the mast through which the line E, G, H, I, passes, being first attached to the model by a nail at K; W, the height; M, the stool which carries the pulley; L, a shore to steady and support the pulley.

All being prepared, the weights were put into the bag until the side of the piece of wood opposite the pulley heeled down into the water to the depth of one inch, previously marked out; and by this means, the scale, as will be presently given, was obtained.

Experiment 6.—*The Scale and Table* A.

No.	Length.	Width.	Depth or thickness.	Floating depth.	Stability.	Ratio.
1.	15 in.	3 in.	2 in.	1 in.	2 oz.	1
2.	15 in.	$4\frac{1}{2}$ in.	2 in.	1 in.	7 oz.	$3\frac{1}{2}$
3.	15 in.	6 in.	2 in.	1 in.	14 oz.	7
4.	15 in.	$7\frac{1}{2}$ in.	2 in.	1 in.	22 oz.	11

The conclusions to be drawn from this scale are, that with the same length the ratio of stability is at its limit of rapid increase when the width is just one-third of the length; or, as 5 : 15 (see No. 2,) being nearly in the cubic ratio. Afterwards, it approaches to the arithmetic ratio.

With respect to the centre of gravity of the four pieces of wood employed upon the occasion, it is right to state they were cut from the same plank of timber, which had been selected on account of its apparent uniform density. And the models, when put on the water, all sunk down to the middle of their thickness, or just one inch out of the two; consequently, their centres of gravity were exactly level with the surface of the water.

Experiments to ascertain the Law of Stability as regards the Increase of Length, the Width and Thickness of the Floating Bodies being constant.

For this purpose, six pieces of wood (deal) were employed, and of the under named dimensions and weights.

Experiment 7.—*Scale and Table* B.

No.	Width.	Length.	Weight.	Stability.	Ratio.
1.	3 in.	3 in.	$1\frac{3}{8}$ oz.	$\frac{1}{4}$ oz.	1
2.	3 in.	6 in.	$2\frac{5}{8}$ oz.	$\frac{3}{4}$ oz.	3
3.	3 in.	9 in.	4 nearly	$1\frac{1}{8}$ oz.	4
4.	3 in.	12 in.	$5\frac{3}{8}$ oz.	$1\frac{3}{8}$ oz.	5
5.	3 in.	15 in.	7 oz.	$1\frac{5}{8}$ oz.	6
6.	3 in.	18 in.	$8\frac{3}{4}$ oz.	$1\frac{3}{4}$ oz.	7

Here the scale of increase is as 1 : 3 when the length is doubled; but after this it takes the arithmetic ratio.

Further Experiments to determine how the Law of Stability operates when the Length and Width of Floating Bodies are constant, the Height or Thickness alone being varied.

The following were the dimensions of the models of deal selected:—

Experiment 8.—*Scale and Table* C.

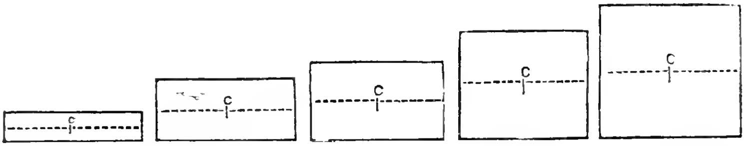
No.	Width.	Length.	Thickness.	Weight.	Stability.	Ratio.
1.	3 in.	9 in.	$\frac{5}{8}$ in.	4 oz.	$1\frac{1}{4}$ oz.	$2\frac{1}{2}$
2.	3 in.	9 in.	$1\frac{1}{4}$ in.	8 oz.	$1\frac{3}{4}$ oz.	$3\frac{1}{2}$
3.	3 in.	9 in.	$1\frac{3}{4}$ in.	12 oz.	$1\frac{1}{2}$ oz.	3
4.	3 in.	9 in.	$2\frac{1}{4}$ in.	16 oz.	1 oz.	2
5.	3 in.	9 in.	3 in.	20 oz.	$\frac{1}{4}$ oz.	$\frac{1}{2}$*

* Or next to nothing, being a cube.

In this table it is seen that when the thickness is in the proportion of 5 : 12 of the width (as in No. 2,) or the depth of flotation one-fifth, say, of the beam, and the centre of gravity at the water level, the stability is at its greatest.

And further, that 4 oz. in weight placed low (as in No. 1 of this table,) more than counterbalances 16 oz., as in (No. 4,) when situated high.

Midsections.—C, the centre of gravity and line of flotation.



No 1. No. 2. No. 3. No. 4. No. 5.

Scale ¼-inch to 1 inch.

If these three tables be admitted as correct, it establishes the rule, that the line of flotation, with regard to depth, and as it affects stability, should be one-fifth of the breadth of the beam, when the body partakes of the parallelopiped form; the centre of gravity being preserved at or just within the level of the surface of the water of the floating body.

Let it be here repeated, relative to all the above experiments, that each piece of deal sunk in the water to half its depth or thickness; therefore, their respective centres of gravity were always on a level with the surface of the water.

To be Continued.

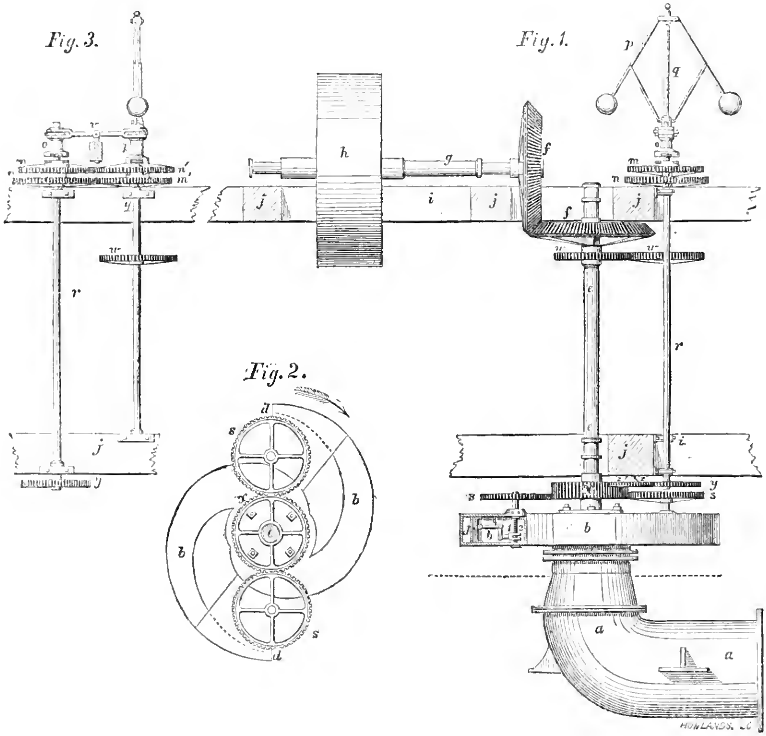
For the Journal of the Franklin Institute.

Launch of the Royal Mail Steamship Arabia.

On Wednesday last one of the new and splendid steamships, belonging to the British and North American Company's line, which have been in course of building at Greenock for some months past, was launched in the presence of a vast concourse of spectators. She is called the *Arabia*, and will be commanded by Capt. Judkins, now of the *Asia*, the veteran Commodore of the British and North American fleet of steamships. Her length is 310 feet; burthen upward of 2400 tons; and she will be fitted up with 2 side lever engines of 1000 horse power; diameter of each cylinder, 103 inches, by 10 feet stroke. The regularity and precision which have so long characterized the *Asia*, the *Europa*, and the other steamships belonging to the British and North American line, reflect the highest credit on their commanders, agents, and all parties concerned. The punctual launch of the Arabia before the close of the present year, as promised, is hailed by the shipping interest on this side as another guarantee for the continuance of that promptitude which has earned for the British North American Company and its spirited agents, Messrs. M'Iver & Co., so distinguished a reputation.

Description of a Regulator or Governor for Water Wheels. Patented by Mr. James Finley, *of Cold Spring, Putnam County, New York.*

Fig. 1 is a side elevation of Finley's Patent Differential Governor, as applied to Whitelaw & Stirratt's patent Water Wheel. Fig. 2 is a plan of the gearing on the top of the water wheel, in connexion with the governor; and fig. 3 is a front elevation of the governor, apart from the water wheel. In which figures the same letters refer to the same parts.



b b is the water wheel, *d d* the jet apertures, *a a* the main pipe, *e* the water wheel shaft, *f f* the main gearing, by which the power is transmitted to the main shaft, *g*, and drum, *h*, and from thence by a band to any machinery on which it may be intended to act. *i i* and *j j* are parts of the framing. *p* is a revolving pendulum, mounted on a spindle, *q*, which in the view shown, fig. 1, is situated beyond a second spindle, *r*, as seen in fig. 3, and is supported by a step on the upper edge of the lower frame, at *i*. This spindle is driven from the water wheel shaft by the cog wheels, *w w*, and carries two cog wheels, *m′ n′*, of different sizes, which gear into two similar cog wheels, *m n*, on the spindle *r*. These wheels are reversed in position, so as to have the smaller on the one spindle, to gear into the larger on the other. *n′* and *n* are keyed fast. *m′* and *m* are

loose, but are capable of being engaged by the cluth boxes, *o* and *k*; the prongs of the latter being sufficiently long to engage *m'*, by extending down through betwixt the arms of *n'*. This clutch box is connected by links to the arms of the revolving pendulum, so as to be drawn upwards or pushed downwards, in accordance with the centrifugal action of the balls, consequent upon the variations of motion; and it is also connected with the clutch box *o*, by a double forked lever, movable on the centre *v*. The result of this connexion being to communicate to the clutch box *o*, the upward and downward motion given to the clutch box *k*, by the arms of the revolving pendulum. The motion thus communicated will be seen to be in opposite directions; the one clutch box moving upwards, whilst the other is moving downwards, and vice versa. *x* is a cog wheel, fitted loosely to a turned seat on the shaft *e*, so as to be at liberty to revolve freely round, independent of that shaft. It is connected through an intermediate stud wheel, *z z*, with a wheel *y*, which is keyed fast on the bottom of the spindle, *r*, and consequently must partake of any variation of motion that may be given to that spindle. *s s* are cog wheels which gear also into *x*, below *y* and *z*. These wheels are mounted on short spindles, which revolve in bearings attached to the water wheel, and have screws formed on the lower end; one of which is seen at 2, fig. 1. On this screw there is a nut with two projecting ears, which are embraced by the forked end of the horizontal arm of the bell crank, 1; the vertical arm of which is connected by the link, 4, with a movable adjusting plate, which forms the inside of the jet aperture at *a*. It will now be obvious, that if the cog wheel, *x*, be made to revolve in either direction, the wheels, *s s*, with their spindles, will revolve accordingly; and by the action of the screws, the nuts held by the forked ends of the bell cranks will either ascend or descend, in accordance with the direction of the motion given to *x*; and will act on the adjusting plates through the agency of the bell cranks and links, so as either to push them outwards, and diminish the width of the jet apertures, or draw them inwards, and increase that width.

Such being the general arrangement of the parts of the governor, its action may be thus explained. Assuming 37 revolutions per minute to be the proper speed of the water wheel, and also the proper speed for the revolving pendulum; let it be supposed that the water wheel having been put in operation, is making 37 revolutions per minute; it will transmit the same speed to the spindle of the revolving pendulum through the equal sized cog wheels, *w w*, and draw up the clutch box, *k*, and also the double forked lever in connexion with it, to the exact position at which they will stand under those circumstances. But by the same action the fork on the opposite end of the lever will push down the clutch box, *o*, on the spindle, *r*, to a corresponding distance. In this state of things the lever is supposed to stand in a level position, holding both clutch boxes out of gear with their respective loose wheels, *m'* and *m*, as represented in fig. 3. It will be obvious that no motion can in this case be transmitted from the spindle, *q*, to the spindle, *r*, and consequently no motion can be transmitted to the wheel, *x*. So long therefore as this state of things continues, no change can take place in the widths of the jet apertures.

Suppose now a part of the resistance to be thrown off the water wheel;

the speed will then begin to increase; but the moment that this takes place, the balls of the revolving pendulum will by their increased centrifugal action recede further from the centre of motion, and raising up the clutch box, *k*, will push down the clutch box, *o*, so as to engage the wheel, *m*. The consequence will be, a speed transmitted through the spindle, *r*, to the wheel, *x*, as much greater than the speed of the water wheel, as the wheel, *n′*, is larger than the wheel, *m*. But the wheel, *x*, being free to move, independent of the water wheel shaft, and being driven in the same direction, will have a relative motion round that shaft precisely equal to this difference of speed. For instance, should this difference be five revolutions per minute, the wheels, *s s*, will each make five revolutions per minute; which acting through the arrangement of parts already explained on the adjusting plates at *d d*, will communicate to them an outward motion, tending to increase the width of the jet apertures, and this action will continue until the water wheel resumes its proper speed; when the lever and clutch boxes will return to their former position, until another change of resistance calls for a renewed action of the governor.

Let it now be supposed that the resistance taken off, has been again put upon the water wheel, and it will be seen that an action precisely similar to what has been already described will take place, but in a contrary direction. The wheel, *x*, will then have a relative motion in a contrary direction to the motion of the water wheel, and an action will consequently be transmitted to the adjusting plates, to draw them inwards, and increase the width of the jet aperture.

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*Photography on Glass.**

Having lately had my attention drawn to the system of obtaining photographic pictures on glass, I was led, by the simplicity of the process, to make some experiments upon it, in the course of which I have succeeded in still further simplifying it. As it is highly probable that many of your readers are interested in this, as well as other branches of photography, I subjoin a description of my modifications. I shall, however, in the first place give a sketch of the mode of operating which I believe is generally adopted by amateurs as being the simplest, for the benefit of such of your readers as may be still unacquainted with this interesting and beautiful process. It is as follows:—Having precipitated an iodide of silver from a solution of its nitrate, by adding to it a solution of iodide of potassium till it is re-disolved. A little of this solution of iodide of silver is then to be added gradually to collodion (a description of which is given below,) and well shaken with it. After settling, this mixture is ready for use. Having procured a piece of plate-glass of the size required, pour over it some of the *iodized* collodion, allowing it to spread over the surface of the glass, so as to cover it completely; and then to flow off at one of the corners. After a little practice, this becomes very easy, and a fine even coating is obtained. The iodized plate is now to be immersed in a solution of nitrate of silver, 30 grains to the ounce of water, till the

* From the Glasgow Practical Mechanic's Journal, December, 1851.

solution flows evenly over its surface, and it is then ready for the camera. After removal from the camera, the picture is developed by pouring over it some of the following mixture:—

Pyro-gallic acid, ...	3 grs.
Glacial acetic acid, ...	1 drm.
Water, ...	1 oz.

When the picture is sufficiently developed, it is first washed with water, and the sensitive coating is removed by means of a strong solution of hyposulphite of soda. It is then to be washed again with water, and when dry, a little thin varnish may be poured over it, to protect it from being rubbed off.

I now come to describe the modifications which I have adopted, and which I find not only simpler, but productive of a better result than can be obtained by the process which I have described.

The first of these relates to the iodized collodion, and was suggested by the idea, that it was unnecessary to add iodide of *silver* to the collodion, as the addition of iodide of potassium *alone*, on immersion in the nitrate of silver, would form the required coating of iodide of silver upon the glass. On trial I found this to be the case.

At this point it may be well to make some remarks regarding the preparation of the collodion, which is of so much importance in this process. It is made, as is now generally known, from gun cotton dissolved in sulphuric ether. There is, however, considerable difference in the mode of preparing the cotton for this purpose. I find the most certain mode of obtaining very soluble cotton, is to make use of nitric acid. Equal bulks of sulphuric acid and nitre will be found to answer very well. Let the cotton be immersed in this mixture, and well saturated with it for about seven or eight minutes; then let it be taken out, and thoroughly washed in water, and dried.

We now arrive at the iodizing process, which may be simply effected thus:—To *pure* sulphuric ether add about $\frac{1}{8}$th of its bulk of alcohol, then a little iodide of potassium, and after this the prepared cotton; let these be well shaken together for some time, and then allowed to settle. Four or five grains of iodide to the ounce of ether will be found sufficient.

The admixture of alcohol to the ether seems to be necessary in preparing collodion for our present purpose, as it will be found, if *pure* ether be employed, that little or no coating will be formed on immersion in the nitrate of silver. It must, at the same time, be observed, on the other hand, that when too much alcohol is added, the coating will be too opaque, preventing the light from penetrating. Thus, little more than the surface of the sensitive coating being acted upon, it is impossible to obtain a bold picture. It is difficult, by description, to point out the depth of coating required, but a very little experience will be sufficient to determine this. The object is to avoid the extremes above mentioned, viz., the having little or no coating at all, and the having a coating too opaque.

From the difficulty I have experienced in always obtaining *pure* ether, (there being often a considerable quantity of alcohol already mixed with it,) I have been obliged to adopt the following mode of preparing iodized collodion. To 1 oz of ether add 5 or 6 grs. of iodide of potassium, and

shake them well together for some time; after settling, the iodized ether should be poured off, and some of the prepared cotton added to it till the proper consistency is attained. Now, prepare a solution of iodide of potassium in alcohol, and add this to the iodized collodion till the coating formed by immersion in the silver solution is considered sufficiently deep. This should be of a milk-like appearance, but at the same time considerably transparent, for reasons before given. By this means, I am enabled with ease, to modify my collodion so as to obtain any depth of coating I may desire; the only objection attending this *adulteration* being, the having to pay the price of ether for so much alcohol, which every one knows is considerably cheaper. My next modification is in the preparation of the developing mixture. It will be noticed that pyro-gallic acid is recommended for this purpose, the acetic acid being added to prevent the pyrogallic from attacking the parts unaffected by light. This, in common with most other acids, it effects; but I have never been able by its use to obtain a pure white. From this circumstance, I was led to try the effects of other acids, and found nitric acid to answer my purpose. A difficulty, however, arose in the nice adjustment required in the proportions of the two acids, which induced me to try another well known developing agent, sulphate of iron, and the result obtained in this way was quite satisfactory. The proportions in this case seem to be of much less importance, so that, with very little care, an excellent developing mixture may be obtained. I subjoin the proportions which I have used with success:—

Sulphate of iron,	12 grs.
Nitric acid,	1 or 2 drops.
Water,	1 oz.

If, from any variation in the strength of the nitric acid, the dark parts of the picture should be spoiled by the action of the sulphate, the addition of a little more acid will be found to prevent the evil.

By means of the above modifications, I have obtained some excellent results; the whites of the picture being very pure, and of a fine metallic appearance, much resembling frosted silver. H. R.

Glasgow, November, 1851.

[We have before us some examples of our correspondent's productions, which possess an amount of brilliancy and boldness unknown in the ordinary Daguerreotype process. Few modern arts can be said to be in a state so essentially transitionary as Photography; but the introduction of glass seems to promise, in its results, to throw all previous inventions into the shade.—Ed. P. M. Journal.

For the Journal of the Franklin Institute.

Trial Trip of the U. S. Steamship "Fulton." By Chief Engineer, B. F. Isherwood, *U. S. Navy.*

Most persons who feel interested in matters of steam navigation, will remember the old U. S. steamship *Fulton*, built about 14 years ago at the Brooklyn Navy Yard, where she has lain since that time a perfect specimen of an utter failure. She was constructed for a war sea steamer, with

which view she was fitted with two horizontal condensing engines of 50 inches diameter of cylinder, by 9 feet stroke; *the engines being placed on the spar deck; each engine working its own paddle wheel independently*, the main shaft not extending across the vessel. Such were the arrangements by which it was contemplated to make a marine war steamer fourteen years ago; the machinery wholly exposed on deck to shot, and rendered almost useless at sea by the absence of connexion between the paddle wheels, so that when one was deeply immersed by the careening of the vessel, and its engine brought to a stand by the increased resistance thrown upon it, the other, being by the same operation so relieved of its resistance that its engine would spin it around with a velocity threatening the destruction of the machinery. Moreover, this well appointed sea steamship carried fuel but for three or four days' moderate steaming. The *Fulton* was also fitted with old fashioned cumbrous *copper* boilers.

In January, 1851, the Chief of the Bureau of Construction, Equipment, and Repair of the Navy Department, (Commodore Chas. Wm. Skinner,) directed the present Engineer in Chief of the Navy, (Gen. Chas. B. Stuart,) to entirely reconstruct the machinery of the *Fulton*, so as to make an efficient war steamer of her, with high speed, and capable of carrying a large amount of fuel. A contract was accordingly made with Mr. H. R. Dunham, of New York, and all the parts of the old engines that could be used were employed; new iron boilers were constructed, and the old copper ones being sold, contributed principally to defraying the cost of the new work.

With regard to the hull, no alterations were made except to the bulwarks on the spar deck, and to the internal arrangements. The model of the hull is peculiar; the two halves from the amidship section being precisely alike and having the water lines full; a model in all respects considered very unfavorable for speed. It was not changed, however, from motives of economy.

The vessel as now finished, together with the machinery, has the following dimensions:

Hull.

Length between perpendiculars,	180 feet
Extreme beam,	34 " 9 inches.
Depth of hold,	12 "
Burthen,	750 tons.
Draft of water on trial trip, forward,	9 feet 6 inches.
Draft of water on trial trip, mean,	10 "
Draft of water on trial trip, aft,	10 " 6 "
Immersed amidship section on trial trip,	298 square feet.
Displacement per inch of draft, at 10 feet draft,	$8\frac{1}{2}$ tons.
Rig.—Fore top-sail schooner.	
Fuel carried on trial trip,	220 tons anthracite.
Fuel carried with bunkers and bags filled,	275 "

Engine.

One condensing inclined engine.

Diameter of cylinder,	50 inches.
Stroke of piston,	10 feet 4 "
Space displacement of piston per stroke,	140·9 cubic feet.
Square feet of immersed amidship section per cubic foot of space displacement of piston per stroke,	2.115 "
Square feet of immersed amidship section per cubic foot of space displacement of piston per stroke, multiplied by number of strokes (20) per minute,	0·106 "

Paddle Wheel.

Overhung side paddle wheels of the common radial kind.

Diameter of wheel from outside to outside of paddles,	24 feet
Length of paddles, ...	7 " 9 inches.
Breadth of paddles, ...	1 " 6 "
Dip of paddles on trial trip, ...	3 " 8 "
Number of paddles in each wheel, ...	20
Areas of two paddles, ...	23·25 square feet.
Proportion of the areas of two paddles to immersed section of hull, ...	1·000 to 12·817

Boilers.

Two iron boilers of the double return drop flue variety.

Diameter of shells (circular shells from end to end,) .	10 feet 6 inches.
Length, ...	24 "
Grate surface, (both boilers,)	112 square feet.
Heating " " "	2600 "
Proportion of heating to grate surface, .	23,214 to 1000 "
Proportion of heating surface per cubic foot of space displacement of piston per stroke, ...	18,453 "
Proportion of heating surface per cubic foot of space displacement of piston per stroke, multiplied by number (20) of double strokes of piston per minute, . . .	0·923 "

The boilers are provided with two fan blowers, 48 inches diameter, to be used if necessary. On the trial trip, it was impossible to ascertain with any exactness, what the consumption of coal was during the steaming.

Performance.

The vessel was tried in New York harbor and outside the Hook, January 1st, 1852. I have taken from the engineer's log of the trip, the speed, steam pressure, revolution of the wheels, &c., between points where they continued uniform, and the disturbing influences of wind and tide were but slightly felt or accurately ascertained. The results thus obtained will show fairly the performance of the vessel.

At 11 h. 3 m. A. M., the flag staffs on Governor's Island and Castle William were in range; at 11 h. $29\frac{1}{2}$ m., the flag staffs on Forts Lafayette and Hamilton were in line; time, $26\frac{1}{2}$ minutes; distance per Coast Survey, 6·75 statute miles; steam pressure in boiler, 25 lbs. per square inch, cut off $\frac{3}{4}$ths stroke; vacuum in condenser, 25 inches of mercury; double strokes of piston per minute, 22; tide slack; weather calm, shown by the flags drooping on their staves.

Speed per hour by Coast Survey Chart, . .	15·283 statute miles.
" " log thrown on board, 13 knots of 6140 feet, or	15·117 "
Slip of the centre of reaction of the paddles, calculated for the 15·283 statute miles, ...	15·45 per cent.
Oblique action of the paddles, ...	16·64 "
Sum of the losses by the paddle wheel,	32·09 "
Mean effective pressure on the piston per square inch, calculated for an initial cylinder pressure 2 lbs. less than boiler pressure, and for a back cylinder pressure 2 lbs. greater than condenser back pressure, ...	32 pounds
Actual power developed by the engine, ...	868·7 horses.

In continuation; ran to S. W. Spit, and rounded the buoy at 12 h. 12 m. P. M.; time, $42\frac{1}{2}$ minutes; distance, 9·25 statute miles; steam pressure in boiler per square inch, 20 lbs., cut off at $\frac{3}{8}$th stroke; vacuum in condenser,

25 inches mercury; double stroke of piston per minute, 19; wind and tide same as before.

Speed per hour by Coast Survey Chart, .	13·059 statute miles.
Slip of the centre of reaction of the paddles, . .	16·34 per cent.
Oblique action of the paddles, ...	16·64 "
Sum of the losses by the paddle wheel,	32·98 "
Mean effective pressure on the piston per square inch, calculated as before, ...	$25\frac{1}{2}$ pounds.
Actual power developed by the engine, . . .	595·77 horses.

In continuation; passed Sandy Hook at 12 h. 21 m. P. M.; distance, 2·00 miles; time, 9 minutes; steam pressure in boiler, 30 lbs. per square inch, cut off at $\frac{3}{8}$th the stroke; vacuum in condenser, 25 inches; double strokes of piston per minute, $20\frac{1}{2}$; light wind abeam, and $\frac{1}{2}$ knot per hour head current.

Speed per hour by Coast Survey Chart, . .	13·333 statute miles.
To which add for current, ...	0·581 "
	13·914
Speed per hour by log thrown on board, . . .	$12\frac{3}{8}$ knots of 6140 feet,
	or 14·201 statute miles.
Slip of the centre of reaction of the paddles calculated for the 13·914 statute miles, ...	17·39 per cent.
Oblique action of the paddles, ...	16·64 "
Sum of the losses by the paddle wheel, .	34·03 "
Mean effective pressure on the piston per square inch, calculated as before, ...	34.07 pounds.
Actual power developed by the engine, . . .	874·72 horses.

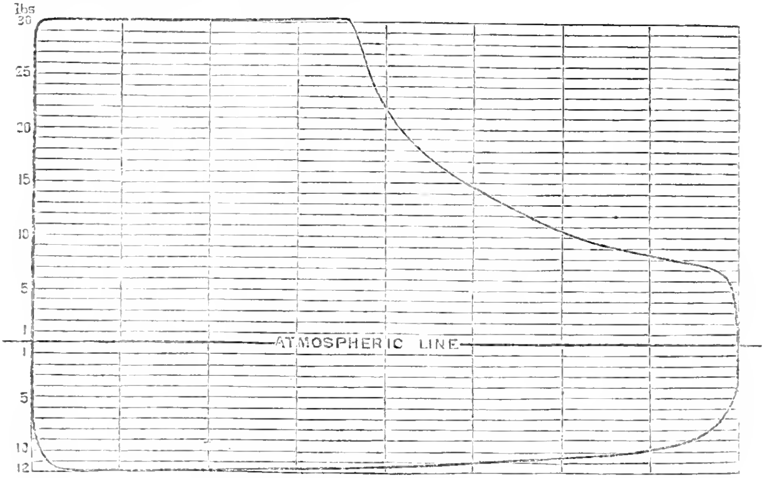
In continuation, ran, with a moderate sea on, (now steaming at sea,) to the Lightship, and was abreast of it at 1 h. 6 m. P. M.; moderate wind a little aft the beam; time, 45 minutes; distance, 8·25 miles; steam pressure in boiler, $27\frac{1}{2}$ pounds per square inch, cut off at $\frac{3}{8}$th the stroke: vacuum in condenser, 25 inches; double strokes of piston per minute, 20; wind on beam.

Speed per hour by Coast Survey Chart, .	11 statute miles of 5280 feet.
	or 9·459 knots of 6140 feet.
Slip of the centre of reaction of the paddles, .	33·06 per cent.
Oblique action of the paddles, ...	16·64 "
Sum of the losses by the paddle wheel,	49·70 "
Mean effective pressure on piston, calculated as before,	34·3 pounds.
Actual power developed by the engine, . .	843·55 horses.

It will appear from the foregoing, that the mean slip of the paddles in still water and calm weather, taken from the first two computations, is $\left(\frac{15{\cdot}45+16{\cdot}34}{2}\right)$ 15·895 per cent; and that the effect of a light wind abeam was sufficient to increase this slip to 17·39 per cent. in still water; while the effect of a moderate wind abeam, coupled with a moderate sea, increased the slip up to 33·06 per cent.

While at sea, the vessel was tried under canvass alone with a moderate wind on the quarter, when she made $4\frac{1}{2}$ knots per hour, dragging the wheels, which were stationary. She was also turned under canvass alone, reversing the direction of her head in 5 minutes.

The accompanying indicator diagram is appended to show the working of the valves, &c.; the cut-off was Sickel's, and momentarily adjustable.



Steam pressure in boiler above atmosphere per gauge, 32 lbs.; vacuum in condenser, 25 inches of mercury; double strokes of piston per min., 22.

For the Journal of the Franklin Institute.

The Steam Navy of the United States now consists of

			In.		Ft.	
Mississippi,	Side Wheel,	Double Engines,	75	×	7	Refitting at Philada.
Susquehanna,	"	"	70	×	10	East India Squadron.
Powhattan,	"	"	70	×	10	Building at Norfolk.
Saranac,	"	"	60	×	9	Gulf of Mexico.
San Jacinto,	propeller,	"	$62\frac{1}{2}$	×	$4\frac{1}{6}$	Mediterranean.
Michigan,	side wheel,	"	36	×	8	Lake Erie.
Fulton,	"	Single Engine,	50	×	$10\frac{1}{2}$	Fitting out at N York.
Princeton,	propeller, double	"	56	×	3	" " Boston.
Water Witch,	side wheel, single	"	36	×	6	Repairs at Washingt'n.
Vixen,	" "	"	36	×	6	Gulf of Mexico.
Alleghany,	propeller, double	"	60	×	4	Repairs at Norfolk.

In addition to the above, there are several small steam vessels (tenders) at the several navy yards, that could, to some extent, be used as transports for moderate distances.

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*The Holyhead Steamers.**

The most successful effort at producing fast steamers has resulted from the competition which the Board of Admiralty induced for separate designs for four steam packets, to occupy the station between Holyhead and Kingstown. The four constructors who submitted plans for these vessels

* From the Glasgow Practical Mechanic's Journal, for December, 1851.

were Sir Wm. Symonds, for the *Caradoc;* Mr. Oliver Wm. Lang, of Chatham dock-yard, for the *Banshee;* Messrs. Miller and Ravenhill, for the *Llewellyn;* and Mr. John Laird of Birkenhead, for the *St. Columba.* The following table states the principal dimensions of these vessels, and also some other information, showing their active and relative capabilities of speed.

PARTICULARS.	Caradoc.	Banshee.	Llewellyn.	St. Columba.
	ft. in.	ft. in.	ft. in.	ft. in.
Length between perpendiculars,	193 0	189 0	190 0	198 $6\frac{1}{2}$
Breadth of vessel,	26 9	27 2	29 6	27 3
Breadth over paddle-boxes,	—	49 6	—	43 6
Depth in hold,	14 9	14 9	—	15 5
Draft of water, forward,	—	8 10	—	9 2
Draft of water, aft,	—	9 2	—	8 $7\frac{1}{2}$
Light displacement in tons,	260	270	323	272
Burthen in tons,	662	670	654	719
Diameter of paddle wheels,	25 6	25 0	30 0	28 0
Nominal horse power of engines,	350	350	350	350
Diameter of cylinder in inches,	74	72	68	70
Length of stroke,	6 0	5 6	4 4	5 6
Revolutions per minute,	28	30	27	$25\frac{1}{2}$
Breadth of paddle wheel,	8 0	9 0	8 6	6 0
Dip of paddle wheel,	—	5 $6\frac{1}{2}$	—	5 $6\frac{1}{2}$
Area of paddle wheel,	—	33 9	30 $10\frac{1}{2}$	27 0
Area of the midship section,	—	190 0	—	—
	h. m. s.	h. m. s.	h. m. s.	h. m. s.
Time occupied in making shortest passage between Holyhead and Kingstown, from 1st Aug. to 31st Dec., 1848,	4 0 0	3 26 0	3 41 0	3 56 0
Rate in knots per hour,	14·0	16·32	15·2	14·23
Rate in miles per hour,	16·13	18·80	17·5	16·37
Time of longest passage,	5 52 0	5 23 0	5 28 0	6 23 0
Rate in knots per hour,	9·5	10·4	10·21	8·77
Rate in miles per hour,	10·94	12·0	11·79	10·10
Average time of passage,	4 30 0	4 2 48	4 15 30	4 38 48
Rate in knots per hour,	12·45	13·84	13·10	12·05
Rate in miles per hour,	14.34	15·95	15·10	13·00
	lbs.	lbs.	lbs.	lbs.
Pressure on the safety valve,	14	14	20	14
	h. m. s.	h. m. s.	h. m. s.	h. m. s.
Time of making shortest passage from 1st Jan. to 1st March, 1849,	3 59 0	3 36 0	3 37 0	4 8 0
Time of longest passage,	5 16 0	7 43 *0	4 50 0	6 30 0
Average time of passage in 1848-9,	4 31 25	4 3 8	4 9 30	4 40 42
Shortest time of passage, from 1st Aug. to 1st Oct., 1849,	3 54 0	2 26 0	3 36 0	4 3 0
Average time of passage, from 1st Aug. to 1st Oct. 1849,	4 26 0	4 3 0	4 6 0	4 40 0

The ordinary performances of these four packets, as well as their performances especially under trial, have determined their relative merits. Their service is one that demands at all times the greatest effort that can be made; and therefore it is no doubt quite fair to conclude that they have done all that they are capable of doing, and that the following order of merit is strictly correct: *Banshee*, first; *Llewellyn*, second; *Caradoc*, third; *St. Columba*, fourth. It will be observed that the pressure of steam

* This passage was made in a state of weather so bad, that no other steam packet ventured to attempt it on that day.

kept up was the same (14 lbs. on the valve) in all except the *Llewellyn*, in which it was 20 lbs. Sufficient time has elapsed to sanction the inference thus drawn of relative excellence as to speed, whilst there is no doubt that each of them bears a character of very high order.—*Fincham.*

Remarks on the Propeller Steamship S. S. Lewis.

This propeller steamship has recently arrived in Boston, after a passage of about 24 days from Liverpool, 20 of it being expended in reaching Halifax, where she arrived short of fuel. It will be remembered that this vessel was constructed in this city during the past season, and was sold to a Boston house, to run from thence to Liverpool. She left there some time during the month of November, and made the passage to within 300 miles of her destination in 11 days, when she broke the blades of her propeller, and was obliged to finish the trip under canvass. On reception of this news, we were informed that she had made this passage *against* head winds and gales; and although every steamer that arrived from Liverpool, reported strong westerly winds, which are unusual at that season of the year, yet we find from the reports of the Lewis, that with her the winds were from the east; a most singular phenomenon, to which I respectfully call the attention of Lieut. Maurey. Very soon after the arrival of the Lewis at Liverpool, the following card appeared in the Public Ledger of this city:

Propellers vs. Side Wheels.

Messrs. Editors—After waiting in vain for some days for some abler pen than mine to notice the great triumph of the "Propeller," in the case of the unprecedented passage of the "S. S. Lewis," I have determined that it should not pass without remark. I say passage, for although some three hundred and odd miles were yet to be accomplished at the time she was disabled, yet it would be fair to infer that during another twenty-four or thirty hours she could have reached her destination, had she not met with the accident. Now, what will the advocates of side wheels say to a ship of her size and limited power, on her first trip, against head winds and gales, making the passage short of twelve days? Is it irrational, under the circumstances, to look for her to cross the Ferry in ten days, after making a few trips, and getting every thing in proper trim? I think not; and I am still more confirmed in my oft expressed opinion, that one-half the power lavished on the side wheel ships would be sufficient to keep up their present speed, were they altered to propellers. The time is coming, I predicted years ago, when we will wonder at the excessive prejudice which has led to squandering millions of dollars.

Now, gentlemen, I have a small crow to pick with the worthy members of the press. Is it their excessive modesty which leads them to overlook all home-made productions as soon as removed from the limits of our village? If this feat had been performed by a British ship, all England would applaud, and we would re-echo their laudations. If the "Lewis" had been a New York, Boston, or Baltimore ship, the news of her trip would have been paraded with encomiums in every newspaper far and near. Why cannot or will not the conductors of the Philadelphia press give the praise that is fully due our excellent mechanics, and our enterprising fellow citizen, R. F. Loper, the projector and builder of the "S. S. Lewis?" Certainly they all deserve it, and a feeling of gratified pride would be no small incentive to new and superior productions. M.

And it is with this article that I have to do. I wish to show to the citizens of this city that every exaggerated statement of this kind does us an injury, and that a proper regard for truth is essential even in reports of steamers, a point where I believe it is not generally expected to be found to any great extent.

In examining the above article by M., it will be observed that he states in effect as follows:

1st, That the Lewis is a large ship with small power.

2d, That if she had not broke her propeller, she would have made the passage in twelve days, against head winds and gales.

3d, That she *will* cross the Ferry, as he calls it, in ten days.

4th, That half the power lavished on side wheel steamers would enable them to maintain their present rates of speed, if they were altered to propellers.

He then gives it as his opinion that the time is coming, which he has often predicted, when we shall wonder at the excessive prejudice which has led to squandering millions of dollars, (on side wheel steamers I suppose he means.) Now, the man who deceives himself is to be pitied, but he who deceives others deserves no such consideration. To which class does M. belong?

The following statements are founded on fact:

1st, That the Lewis has as much power as most side wheel steamers of her tonnage, for she has two boilers, 21 feet long, 11 feet 6 inches wide, and 11 feet 2 inches high, containing full 5600 feet of fire surface; and as she is only about 1150 tons Custom House measurement, it follows that she has nearly 5 feet of fire surface per ton, while there is not a side wheel steamer out of the port of New York, having boilers of *similar* character, that has as great a ratio; they usually have from 3 to 4 square feet per ton. The amount of boiler that a steamer has is the measure of her power.

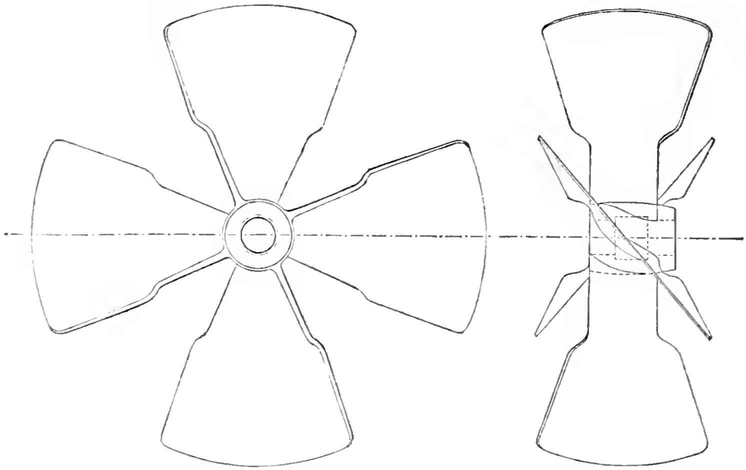
2d, I say she did not have head winds and gales during *the whole* of her passage, or any considerable portion of it; for the reason that every steamer coming westward, reported heavy head winds, (which usually prevail at that season of the year,) and the wind does not blow in two opposite directions at the same time; and also because on her return trip, when there is no question but the wind was ahead, she was 20 days in reaching Halifax. Now, both accounts cannot be correct, (the latter we know is,) or the easterly gales and head winds do not compare with those from the west.

3d, She will not cross *the Ferry* in 10 days, for she no doubt did her best on the first trip, and that would not have been done in 12 days, even without accident.

4th, Half the power of a side wheel steamer put into a propeller, would not enable her to be equal in speed to the former; on the contrary, no propeller can be found, having equal power, that can maintain equal speed to a side wheel steamer at sea, and no line of propellers can be found running in successful competition with side wheel steamers. By successful competition, I mean making as good time, or obtaining as high rates of freight and passage money.

The City of Philadelphia has for the past few years been noted for the number of propellers that have been built here, through the enterprise of one of her most active citizens; they are rightly considered a valuable addition to our merchant or naval service, and I have no wish to say aught against them. But I am utterly opposed to that system which makes every man a hero, or every propeller a Pacific; modest merit does not blow its own horn.

The dimensions of the S. S. Lewis are as follows:—Length, 225 feet; beam, 32 feet; depth, 27 feet; and in addition, a house on deck, which is too great a depth for her beam, and would have a strong tendency to make her top-heavy without ballast, and no successful steamer can be found that requires ballast.



Scale, 3-16 in. to one foot.

Her engines are two in number, connected at right angles. Diameter of each cylinder, 60 inches; length of stroke 40 inches. The crank shaft carries a large spur wheel, which gears into a pinion on the propeller shaft, and drives the latter $1\frac{3}{4}$ revolutions to 1 of the former. The propeller is of cast iron, of the following dimensions and form:—Diameter, 13 feet; angle at hub, 30°; angle at periphery, 50°; pitch at periphery, 34 feet; pitch at hub, 11 feet. FULTON.

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*Improvements in the Manufacture of Gas.**

The competition which has of late years sprung up in the supply of the important article of gas to the inhabitants of the large towns of the United Kingdom, has not existed long without the production of one of its legitimate effects. It has drawn the attention of parties skilled in the chemistry of gas manufacture, and careful observers of the circumstances under which the best results are obtained, to the study of improved methods of treating the various substances capable of being used in the production of gas; and the first fruits are visible in the process lately patented by Messrs. Barlow and Gore, which, in the opinion of some of our most experienced gas engineers, is destined to produce a speedy revolution in the manufacture of gas, and materially to diminish the cost of its production.

The processes are based, 1st, Upon an improved method of rendering luminous the gases resulting from the perfect decomposition of water or steam; and, 2d, Upon the conservative influence which hydrogen exer-

*From the London Mining Journal, No. 845.

cises in protecting the matter upon which the illuminating power of gas depends from decomposition by heat.

The first has been attempted by Donovan, Manby, White, Webster, and others, with dubious and disputed success. Their failures are all traceable to the same sources—first, to the impossibility of insuring the complete decomposition of the water or steam by any of the means employed by them, and to the consequent production of a large quantity of vapor, exercising a fearfully destructive influence over the carbonaceous matter undergoing decomposition for the purpose of rendering the water gases luminous; and, secondly, to the presence in the water gases of from 10 to 15 per cent. of carbonic acid, the injurious effects of which upon the flame need not be here further alluded to, and the expenses of abstracting which by any of the ordinary methods are so considerable as materially to augment the cost of manufacture, besides diminishing the volume of saleable gas. The present patentees propose to obviate these difficulties by first *condensing* the water gases, so as to deprive them of all excess of vapor, and then to pass them through a heated retort containing carbonaceous matter, by which the whole of the carbonic acid gas will be converted into twice its bulk of carbonic oxide gas, and the pure hydrogen and carbonic oxide gases in equal volumes, free from carbonic acid, are afterwards admitted in regulated quantities into retorts where carbonaceous matter is undergoing distillation or decomposition, and by which they are rendered highly luminous. The conservative effect of hydrogen upon olefiant gas has not, we believe, hitherto been noticed by chemists. It may, however, be demonstrated by the following very simple experiment:—If olefiant gas be passed through a red-hot tube, the carbon will be deposited, and the gas be thereby converted into light carburetted hydrogen, a gas of very low illuminating power. If, however, hydrogen be added to the olefiant gas, the same process may be repeated without causing any deposition of carbon, and with only a diminution of illuminating power in the mixed gases, due to the increased volume of the non-illuminating gas—hydrogen.

The practical effect of this property, when applied to gas making, is to reduce the quantity of condensible products, such as tar, &c., and entirely to prevent the deposit of carbon on the interior surfaces of glass retorts.

The importance of these discoveries will be readily understood, when we state that the experience of the patentees leads them to the conclusion that upwards of fifty per cent. may be added to the volume of gas yielded by all descriptions of materials ordinarily used for that purpose, without any diminution of the illuminating power, so that 15,000 cubic feet will be the probable future produce from one ton of Newcastle coal, and 75,000 cubic feet of London gas from the same quantity of Boghead Cannel, the ashes from which are further stated to be the best material known for the manufacture of alum; the residue, after the abstraction of the alumina, being also valuable for the manufacture of pottery, porcelain, and glass, and as a dentifrice, a polishing powder, and decolorant—truly we live in an age of invention and wonders. We may add that the Chartered Gas Company of London, the patriarch of gas companies, have agreed with the patentees for licenses to use the processes at all their works.

For the Journal of the Franklin Institute.

On the Friction of Marine Engines. *By* J. V. Merrick.

In the calculations deduced from experiments for ascertaining the power employed in the propulsion of steam vessels, it is important to determine the loss in utilized effect, resulting from the friction of the engine. This loss has been variously stated by different authors, who have, however, so far as I am aware, given only approximate estimates, without calculating it from known data. Exact results cannot, it is true, be obtained, because the condition of the "journals" or rubbing surfaces varies so constantly, whether from improper keying up, or imperfect lubrication, that the same engine would give very different coefficients at different times. It would, however, be interesting to inquire what is the friction incident to a normal state of affairs, and upon that basis, make allowances according to the circumstances of any special case.

The losses consequent upon friction may be stated as follows: 1st, the friction on the rubbing surfaces depending on the weight; 2d, the friction and resistance of the air to the moving parts; these, with the force required to work the air and feed pumps, and the valves, with the friction of these forces, make up a sum, which expresses what is called the "power to work the engine without load." If to this we add, 3d, the friction of the load put upon the engine, we shall have expressed all the deductions to be made from the gross power developed by a marine engine, in order to find that transmitted to the wheels or propeller.

Of these causes of loss, the (2d) resistance of the air to the moving parts, is too trifling to enter into a calculation of practical value. That of the air pump varies, of course, with the head against which the waste water is discharged, with the vacuum attained, etc.; but as an average for marine side lever engines, upon which form the present calculation is based, (when steam is expanded two to three times,) it has been found by indicator diagrams, to vary from 6 to 7 pounds per square inch of area of the air pump. When the latter has a capacity of $\frac{1}{5}$th the cylinder, the resistance in pounds per square inch of cylinder piston would be $r=\frac{(6+7)\times\cdot20}{2\times2}=0{\cdot}65$; since the air pump piston makes but one working stroke, while that of the cylinder performs two. If the ratio of capacities be ·22, then $r=\frac{6{\cdot}5\times\cdot22}{2}=0{\cdot}715$, and if ·24, then $r=\frac{6{\cdot}5\times\cdot24}{2}=0{\cdot}78$; if only ·18, $r=\frac{6{\cdot}5\times\cdot18}{2}=\cdot585$. Hence it may be stated in general terms, that the mean resistance caused by the air pump, is $\frac{7}{10}$th pound per square inch of the steam piston.

The friction of journals was found by Morin, (*Leçons de Mécanique Pratique*, 1re *Partie*,) to be unaffected by the velocity and extent of surface, and dependent simply on the pressure. The coefficient is stated to be ·05 the pressure when lubrication is constantly applied, and ·075 when it is renewed from time. As the latter is generally the case, we shall employ that coefficient.

The power required in a given time, to overcome the friction of any journal, will therefore be the product of this coefficient, by the mean pressure exerted upon it, and by the distance passed over by a point in the circumference of the journal during that time. Hence, the greater the diameter of a journal, other things being equal, the greater will be the friction, because with the same angular motion, a point in the circumference passes over a greater distance.

In calculating the friction without load, I shall take for an example a side lever engine of 72 inch cylinder, 8 feet stroke, of which I have the weights; a similar process may be applied to any other description of engine with equally correct results.

In this instance, if D represents the diameter of the cylinder, that of the main shaft journals is 0·2 D; outboard journals, 0·14 D; crank pins, 0·125 D; end beam pins, 0·084 D; air pump beam pins, 0·06 D; side lever centres 0·167 D; the angular motion of the side lever during a double stroke is $0{\cdot}28 \times$ circumference; hence the distances passed over during that time will be respectively—end beam pins, $\cdot28 \times 3{\cdot}1416 \times \cdot084\ D = 0{\cdot}074\ D$; main journals, $3{\cdot}1416 \times \cdot2D = 0{\cdot}63\ D$; outboard journal, S=0·44 D; crank pin=0·39 D; side lever centre,=0·145 D; air pump beam pins= 0·053 D.

The weights in round numbers are, on the outboard journals, 62,000 lbs., main journals, 31,000; crank pin, 4000; cross tail pins, 12,000; side rod pins, 16,000; air pump pins, 6000, and on the side lever centres, 56,000. The friction of weight will therefore be, (remembering that D=6 feet,)

Main journals,	·075 × 31,000	× ·63	D =	8790 lbs.	lbs.
Outboard journals,	" × 62,000	× ·44	" =	12276 "	21,066 "
Crank pin, weight,	" × 4,000	× ·39	" =	702 "	
" " previous friction	" × 21,066 ÷ 16	× ·39	" =	232 "	934 "
Cross tail pins, weight,	" × 12,000	× ·074	" =	400 "	
" " previous friction,	" × 2,000 ÷ 16	× ·074	" =	46 "	446 "
Air pump pins, weight,	" × 6,000	× ·053	" =	138 "	138 "
Side rod " "	" × 16,000	× .074	" =	533 "	
" " previous friction,	" × 2,446 ÷ 16	× ·074	" =	47 "	580 "
Side lever centres, weight,	" × 56,000	× ·145	" =	3660 "	
" previous friction	" × 44,992 ÷ 16	× ·145	" =	184 "	3,844 "
Whole friction for a double stroke,					27,008

Therefore, the power required to be developed by the engines=area of cylinder × twice stroke × x,=27008, and x=pressure in pounds per square inch of piston$=\frac{27{,}008}{4071 \times 16}=0{\cdot}36$, or allowing for imperfect lubrication, say $\frac{1}{2}$-pound.

To this must be added, the friction of packing in the cylinder and pumps; an element very difficult to fix upon, as it depends entirely on the description and condition of the packing employed. In the absence of direct experiment, observation induces me to believe that this friction in well kept packing, does not exceed from $\frac{1}{2}$ to 1 pound per square inch of rubbing surface, which on a 72 inch cylinder with rings 5 inches deep, would amount to, from 615 to 1230; in that case, the area of piston, being 4071, the pressure required would be $\frac{615}{4071}$ to $\frac{1230}{4071}=0{\cdot}15$ to $0{\cdot}30$ lbs. For the air pump, the same assumption would give per square inch of its area,

0·22 to 0·43, which by ·21 (ratio of capacities,)=0·046 to 0·092 lbs. on the steam piston. Finally, the friction of the power required to work the air pump is almost inappreciable, (about $\frac{1}{400}$th of a pound per square inch,) and may be neglected without serious error.

Summing up these elements we have,

1. Power to work the air pump,		0·585	to	0·780
2. Friction of weight,		0·500	"	0·500
3. " cylinder packing,		0·150	"	0·300
4. " air pump packing,		0·046	"	0·092
5. Power to work balance valves, Friction of Parallel motion, Resistance of the air, &c.	say	0·169	"	0·178
To work the engine without load,		1·450	"	1·850

Mean $\frac{1·450+1·050}{2}$=1·65 pounds per square inch. If the journals were kept constantly lubricated, as is the case when automaton lubricators are employed, the friction of weight would be only $\frac{·50\times·05}{·075}$=·33, and the pressure would be reduced to 1·65—·17=1·48 pounds per square inch. It therefore appears to me that 1·75 and 1·50 pounds would be a just allowance in these two cases respectively.

There now remains to be considered, the value of the friction of any load which may be put upon an engine of this description. It would be a tedious operation to obtain this with perfect accuracy, because, beginning at the cylinder with a given pressure, the friction of the several parts would gradually diminish it, until, arriving at the shaft journals, it would be less by the whole friction of the engine. But it may be found with sufficient exactness for our present purposes, as follows:

Calling P=the mean pressure on the piston, over and above that required to work the engine without load, and A=the area of the cylinder in inches, then, as D=6 feet,

Friction on side rod pins	= ·075 AP×0·74	D=	·0333AP
" crosstail pins	= AP×0·74	"	·0333 "
" side lever centres	= 2 AP×0·145	"	·1305 "
" crank pin	= $\frac{2}{3·14}$ AP×0·39	"	·1118 "
" main journals	= $\frac{2}{3·14}$ AP×0·63	"	·1813 "
Total friction during a double stroke,			4902 "

But as the whole power developed in this time is AP×2S (S=8)=16AP, therefore, $\frac{·4902}{16}$=0·0307, the proportion of the whole power employed in overcoming friction of load, or if automaton lubricators be used, ·0307×$\frac{·05}{·075}$=0·0205, or two per cent. When it is recollected that this calculation is based upon perfect keying up, and proper lubrication, points which are generally not so well looked to as they should be, it does not appear that 4 and 5 per cent., respectively,are far from the true value of friction in ordinary cases.

The friction of any other form of engine might be calculated in the same manner, and I think a comparison would show that the side lever engine is not *quite* so much behind some others in this point of view, as has been commonly supposed.

*Steam Marine of the United States.**

At the last session of Congress, the Senate, by resolution, directed the Secretary of the Treasury to collect and report statistics, exhibiting officially the External and Internal Steam Marine of the United States. William D. Gallagher, Esq., was commissioned to obtain the Inland, and Professor E. D. Mansfield the External; and most faithfully and ably have they discharged the arduous duty. The aggregate results far exceed, in magnitude and importance, the most extravagant estimates and anticipations. These reliable facts and statistics were reported to the Senate on Thursday last, by the Secretary of the Treasury. We take the subjoined statements from that Report:

The Steam Marine of the United States, on the Atlantic and Pacific Coasts and the Gulf of Mexico, is as follows:

From Passamaquoddy Bay to Cape Sable, there are 46 ocean steamers; 274 ordinary steamers; 65 propellers, and 80 ferry boats. Tonnage, 154,270 tons. High pressure steamers, 116; low pressure, 342. Number of officers and crews, 8,348. Passengers annually, 33,114,782. Average miles traveled, 8,118,989. These statistics refer to the year ending July 1, 1851.

The steam marine on the Gulf of Mexico, from Cape Sable to the Rio Grande, consists of 12 ocean steamers; 95 ordinary steamers; 2 propellers. Tonnage, 23,244. High pressure, 97; low pressure, 10. Number of officers and crews, 3,473. Passengers during the year, 148,700. Number of miles traveled, 1,360,380.

The steam marine on the Pacific Coast consists of 37 ocean steamers; 13 ordinary steamers. Tonnage, 34,986. High pressure, 3; low pressure, 47. Officers and crews, 1949. Average miles traveled, 79,209.

The aggregates of the external steam marine are:

Ocean steamers, 96; ordinary steamers, 382; propellers, 67; ferry boats, 80. Total, 625. Total tonnage, 212,500. High pressure, 213; low pressure, 412. Officers and crews, 11,770. Annual passengers, 33,342,846. Of the annual passengers, 24,009,550 were by ferry boats.

The Shipwrecks in the United States, on the Atlantic and Pacific Coasts and Gulf of Mexico, during the year ending July 1, 1851, were 50 ships, 59 brigs, 190 schooners, 9 sloops, and 20 steamers. Total, 328; of which 278 were by tempest, 14 by fire, 15 by collision, 19 by snags, and 2 by explosion. The number of lives lost was 318.

The "human movement," by steamboat, on the principal tide water lines was as follows:

	No. of Pass'rs.
On Long Island Sound,	302,397
On Hudson River,	995,100
Between New York and Philadelphia by Steamers.	840,000
On Potomac and James Rivers and Chesapeake Bay,	422,100
Gulf of Mexico,	169,508
Pacific Coast,	79,209

In 26 Districts on the Atlantic Coast, there were 160 vessels lost, valued at $1,559,171, and on which insurance was paid to the amount of $968,350.

* From the New York Tribune, January 26, 1852.

In New York, the marine insurance paid was	$ 3,520,161
In Philadelphia,	906,616
In Boston,	554,865

The total marine (not inland) insurance paid during the year is estimated at $6,227,000.

The Inland Steam Marine of the United States comprises three grand divisions—the Northern Frontier, the Ohio Basin, and the Mississippi Valley:

	Steamers.	Tonnage.	Officers & Crew.	Passengers.
The Northern Frontier has	164	69,165	2,855	1,513,390
The Ohio Basin,	348	67,601	8,338	3,464,967
The Mississippi Valley,	255	67,957	6,414	882,593
Total,	765	204,723	17,607	5,860,950

Of the passengers, 2,481,916 were by ferry boats, and in addition to the above, there were 1,325,911 passengers by railroads, 86,000 by canals, and 27,872 by stages, on the Northern Frontier line of travel, and 265,936 railroad and 28,773 stage passengers on the Ohio Basin line.

Travel to and from Inland Commercial Centres.

Pittsburgh (last year),	466,856
St. Louis,	367,795
Buffalo,	622,423
Chicago,	199,883
Total,	1,656,957

The resident population of these four cities is but 217,966.

The travel to and from Buffalo "comes and goes" as follows:

By ordinary steamers,	157,257
Propellers,	14,300
Ferry Boats,	26,280
Buffalo and Rochester Railroad,	262,386
Niagara Railroad,	119,200
Erie Canal,	43,000
Total,	622,423

St. Louis has 131 steamers; New Orleans, 109; Detroit, 47; Buffalo, 42; Pittsburgh, 12. During eight years, ending July 1, 1851, the tonnage in the Buffalo District has increased 19,217 tons; in Presque Isle, 2778; Cuyahoga, 4563; and in Detroit, 14,416. The steamboat tonnage of the Upper Lakes has more than quadrupled in eight years, and on the Mississippi Valley it has doubled in nine years.

The steamboat disasters on the Mississippi and tributaries since the introduction of steam to the year 1848, are, by collision, 45; fire, 104; snags, 469—total, 618. The original cost of the boats, $9,899,748; deficiency in value, $5,176,757; final losses, $4,719,991. The loss in 1849 is stated at $2,000,000.

Losses on the lakes and rivers during the year ending July 1, 1851, by tempest, 35; fire, 30; collision, 18; snags, 32. Persons lost on the lakes, 87, and on the rivers, 628—total, 695.

The average tonnage of Lake steamers is 437 tons; of the Ohio Basin, 206; and of the Mississippi Valley, 273.

Of the 558 ordinary steamers on the rivers, 317 are enrolled in the Districts of the Ohio Basin, and 241 in those of the Mississippi Valley.

Of the 147 ordinary steamers and propellers on the Lakes, 31 are enrolled on the Lakes Champlain and Ontario and the St. Lawrence, 66 on Lake Erie, and 60 at Detroit and the Lakes above.

Of the 164 steam vessels on the Lakes, 105 are ordinary steamers, 52 are propellers, and 43 are ferry boats.

Of the 601 steam vessels on the rivers, 558 are ordinary, and 43 are ferry boats.

With but two very slight exceptions, there is an uninterrupted line of steam navigation from the waters of the Gulf of St. Lawrence to those of the Gulf of Mexico—a distance of about 28,000 miles, and upon which is employed, for the purposes of trade and travel, a steam tonnage of 60,166 tons. The Ohio Basin forms, of itself, a cross section of about 1100 miles in length.

The steam marine of Great Britain and her dependencies is stated to consist of 1184 boats, with 142,080 tonnage; while the inland steam marine of the United States consists of 766 boats, with a tonnage of 204,613 tons—showing that, exclusive of the steam tonnage of the Atlantic and Pacific seaboard and the Gulf coast, the inland steam tonnage exceeds that of Great Britain and her dependencies by 62,533 tons.

On the Production of Instantaneous Photographic Images. By H. F. Talbot.*

It will probably be in the recollection of some of your readers that in the month of June last a successful experiment was tried at the Royal Institution, in which the photographic image was obtained of a printed paper fastened upon a wheel, the wheel being made to revolve as rapidly as possible during the operation.

From this experiment the conclusion is inevitable, that it is in our power to obtain the pictures of all moving objects, no matter in how rapid motion they may be, provided we have the means of *sufficiently* illuminating them with a sudden electric flash. But here we stand in need of the kind assistance of scientific men who may be acquainted with methods of producing electric discharges more powerful than those in ordinary use. What is required is, vividly to light up a whole apartment with the discharge of a battery:—the photographic art will then do the rest, and depict whatever may be moving across the field of view.

I had intended to communicate much earlier the details of this experiment at the Royal Institution, but was prevented from doing so at the time,—and soon afterwards I went on the Continent in order to observe the total solar eclipse of the 28th of July. This most interesting phenomenon I had the pleasure of witnessing at the little town of Marienburg, in the north-eastern corner of Prussia. The observations will appear, I believe, in a forthcoming volume of the Transactions of the Royal Astronomical Society. Among other things, I was enabled to make a satisfactory estimate of the degree of darkness during the total obscuration, which proved to be equal to that which existed one hour after sunset the same evening, the weather being during that evening peculiarly serene, so as to allow of a just comparison.

* From the London Athenæum, December, 1851.

This Continental journey having effectually interrupted my photographic labors, I have only recently been able to resume them. I shall, therefore, now proceed to describe to you exactly the mode in which the plates were prepared which we used at the Royal Institution: at the same time not doubting that much greater sensibility will be attained by the efforts of the many ingenious persons who are now cultivating the art of photography. And it is evident that an increased sensibility would be as useful as an augmentation in the intensity of the electric discharge.

The mode of preparing the plates were as follows:—

1. Take the most liquid portion of the white of an egg, rejecting the rest. Mix it with an equal quantity of water. Spread it very evenly upon a plate of glass, and dry it at the fire. A strong heat may be used without injuring the plate. The film of dried albumen ought to be uniform and nearly invisible.

2. To an aqueous solution of nitrate of silver add a considerable quantity of alcohol, so that an ounce of the mixture may contain three grains of the nitrate. I have tried various proportions, from one to six grains, but perhaps three grains answer best. More experiments are here required, since the results are much influenced by this part of the process.

3. Dip the plate into this solution, and then let it dry spontaneously. Faint prismatic colors will then be seen upon the plate. It is important to remark, that the nitrate of silver appears to form a true chemical combination with the albumen, rendering it much harder, and insoluble in liquids which dissolved it previously.

4. Wash with distilled water to remove any superfluous portions of the nitrate of silver. Then give the plate a second coating of albumen similar to the first; but in drying it avoid heating it too much, which would cause a commencement of decomposition of the silver. I have endeavored to dispense with this operation, No. 4, as it is not so easy to give a perfectly uniform coating of albumen as in No. 1. But the inferiority of the results obtained without it, induces me for the present, to consider it as necessary.

5. To an aqueous solution of prot-iodide of iron add *first*, an equal volume of acetic acid, and then ten volumes of alcohol. Allow the mixture to remain two or three days. At the end of that time it will have changed color, and the odor of acetic acid as well as that of alcohol will have disappeared, and the liquid will have acquired a peculiar or agreeable vinous odor. It is in this state that I prefer to employ it.

6. Into the iodide thus prepared and modified the plate is dipped for a few seconds. All these operations may be performed by moderate daylight, avoiding, however, the direct solar rays.

7. A solution is made of nitrate of silver, containing about 70 grains to one ounce of water. To three parts of this add two of acetic acid. Then if the prepared plate is rapidly dipped once or twice into this solution it acquires a very great degree of sensibility, and it ought then to be placed in the camera without much delay.

8. The plate is withdrawn from the camera, and in order to bring out the image it is dipped into a solution of protosulphate of iron, containing one part of the saturated solution diluted with two or three parts of water. The image appears very rapidly.

9. Having washed the plate with water it is now placed in a solution

of hyposulphite of soda, which in about a minute causes the image to brighten up exceedingly, by removing a kind of veil which previously covered it.

10. The plate is then washed with distilled water, and the process is terminated. In order, however, to guard against future accidents, it is well to give the picture another coating of albumen or of varnish.

These operations may appear long in the description, but they are rapidly enough executed after a little practice.

In the process which I have now described, I trust that I have effected a harmonious combination of several previously ascertained and valuable facts,—especially of the photographic property of iodide of iron, which was discovered by Dr. Woods, of Parsonstown, in Ireland, and that of sulphate of iron, for which science is indebted to the researches of Mr. Robert Hunt. In the true adjustment of the proportions, and in the mode of operation, lies the difficulty of these investigations, since it is possible by adopting other proportions and manipulations not very greatly differing from the above, and which a careless reader might consider to be the same, not only to fail in obtaining the highly exalted sensibility which is desirable in this process, but actually to obtain scarcely any photographic result at all.

To return, however, from this digression. The pictures obtained by the above described process are negative by transmitted light and positive by reflected light. When I first remarked this, I thought it would be desirable to give these pictures a distinctive name, and I proposed that of *Amphitype*, as expressive of their double nature, at once positive and negative. Since the time when I first observed them, the Collodion process has become known, which produces pictures having almost the same peculiarity. In a scientific classification of photographic methods, these ought, therefore, to be ranked together as species of the same genus. These Amphitype pictures differ from the nearly related Collodion ones in an importance, viz., the great hardness of the film and the firm fixation of the image, which is such that in the last washing, No. 10, the image may be rubbed strongly with cotton and water without any injury to it; but, on the contrary, with much improvement, as this removes any particles of dust or other impurity, and gives the whole picture a fresh degree of vivacity and lustre. A daguerreotype picture would be destroyed by such rough usage before it was completely fixed and finished.

In examining one of the amphitype pictures, the first thing that strikes the observer is, the much greater visibility of the positive image than of the negative one; since it is not rare to obtain plates which are almost invisible by transmitted light, and which yet present a brilliant picture full of details when seen by reflected light.

The object of giving to the plates a second coating of albumen, as prescribed in No. 4, is chiefly in order to obtain this well developed positive image; for it is a most extraordinary fact, that a small change in the relative proportions of the chemical substances employed enables us at pleasure to cause the final image to be either entirely negative or almost entirely positive. In performing the experiment of the rotating wheel the latter process must be adopted; since the transmitted or negative image is not strong enough to be visible unless the electric flash producing it be an exceedingly bright one.

I now proceed to mention a peculiarity of those images which appear to me to justify still further the name of Amphitype, or, as it may be rendered in other words ambiguous image. Until lately I had imagined that the division of photographic images into *positive* and *negative* was a complete and rigorous one, and that all the images must be of either the one or the other kind. But a third kind of image of a new and unexpected nature is observed upon the Amphitype plates. In order to render this intelligible, I will first recall the general fact that the image seen by transmitted light is negative and that by reflected light positive. Yet, nevertheless, if we vary the inclination of the plate, holding it in various lights, we shall not fail speedily to discover a position in which the image is positive although seen by transmitted light. This is already a fact greatly requiring explanation. But the most singular part of the matter is, that in this new image (which I call the *transmitted positive,*) the brightest objects (viz: those that really are brightest, and which appear so in the *reflected positive*) are entirely wanting. In the places where these ought to have been seen, the picture appears pierced with holes, through which are seen the objects which are behind. Now, if this singularity occurred in all the positions in which the plate gives a positive image, I should be satisfied with the explanation that the too great brightness of the objects had destroyed the photographic effect which they had themselves at first produced. But since this effect takes place in the *transmitted positive* but not in the *reflected positive,* I am at a loss to suggest the reason of it, and can only say that this part of optical science, dependent upon the molecular constitution of bodies, is in great need of a most careful experimental investigation.

The delicate experiment of the revolving wheel requires for its success that the iodide of iron employed should be in a peculiar or definite chemical state. This substance presents variations and anomalies in its action which greatly influence the result. Those photographers, therefore, who may repeat the experiment will do well to fix their principal attention upon this point. It is also requisite in winter to warm the plates a little before placing them in the camera. In pursuing this investigation, I have been much struck with the wide field of research in experimental optics which it throws open. By treating plates with albumened glass with different chemical solutions, the most beautiful Newtonian colors, or "colors of thin plates," may be produced. And it often happens that the landscapes and pictures obtained by the camera present lively though irregular colors. These not being in conformity with nature are at present useless; with this exception, nevertheless, that in many pictures I have found the color of the sky to come out of a very natural azure blue. I hope soon to have the leisure requisite for pursuing this very interesting branch of inquiry, and in the mean time I venture to recommend it to the notice of your scientific readers.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, January 15, 1852.

S. V. Merrick, President, in the chair.

John F. Frazer, Treasurer.

J. Vaughan Merrick, Recording Secretary, P. T.

The minutes of the last meeting were read and approved.

A Letter was read from the Royal Geographical Society, London.

Donations were received from The Royal Astronomical Society, London; The Royal Irish Academy, Dublin; Ellwood Morris, Esq., Pittsburgh, Penn'a.; and Messrs. Charles E. Smith, Julius H. Rae, Percival Roberts, John C. Trautwine, William Firmstone, and A. W. Rae, Philadelphia.

A complete Geological suit of 700 Specimens, selected and arranged by the Mineralogical Institute of Heidelburg, Germany, accompanied by printed catalogues and printed labels in German, French, and English, was purchased and presented to the Institute by several of the members.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of December; also, his annual statement of the Funds of the Institute, and the annual statement of the transactions of the Journal of the Institute.

The Board of Managers and Standing Committees reported their minutes.

The Committee on the Library reported that they had so amended the regulations for the government of the Library, as to allow members to take from the Library, during the recess of the meetings of the Committee, books belonging to the "First Class," on obtaining the consent in writing of two members of the Committee.

On motion, the amendment was approved by the Institute.

The Committee on the School of Design for Women, and the Trustees of the Elliott Cresson Medal, not being prepared to report—Mr. F. Fraley made a verbal statement in relation thereto, and said that the regular reports in writing would be submitted at the next meeting of the Institute.

New candidates for membership in the Institute (15) were proposed, and the candidates (21) proposed at the last meeting were duly elected.

The Tellers of the annual election for Officers, Managers, and Auditors, for the ensuing year, reported the result, when the President declared the following gentlemen as duly elected:

Samuel V. Merrick, President.

Thomas Fletcher, } Vice Presidents.
Abraham Miller, }

Isaac B. Garrigues, Recording Secretary.

Solomon W. Roberts, Corresponding Secretary.

John F. Frazer, Treasurer.

MANAGERS.

M. W. Baldwin,	Owen Evans,	Eliashib Tracy,
Frederick Fraley,	Alan Wood,	Geo. P. Whitaker,
John Agnew,	Asa Whitney,	Jos. J. Barras,
John Wiegand,	Isaac S. Williams,	Geo. N. Eckert,
John C. Cresson,	H. P. M. Birkinbine,	Charles E. Smith,
John H. Towne,	Geo. W. Conarroe,	John C. Trautwine,
Edwin Greble,	Thos. J. Weygandt,	Wm. D. Parrish,
David S. Brown,	Peleg B. Savery,	Frederick Graff.

AUDITORS.

Algernon S. Roberts, Samuel Mason,
Uriah Hunt.

Dr. Rand exhibited to the meeting, through the kindness of Mr. Cornelius, a form of Argand Burner, having an annular jet, the inconveniences of which form of jet were obviated by the peculiar arrangement of concentric cones composing it, and the manner in which the supply of air is admitted and regulated. The photometric results of this burner will be communicated at a future meeting, in the report of which a more detailed account of its construction will be made.

Mr. Bartol gave an account of the operation of the combined Vapor Engine, which he had seen in a recent visit to New York.

Mr. G. W. Smith explained the method adopted at the establishnent of Reeves, Buck & Co., Phœnixville, Penn'a, for the manufacture of old and worn Railroad Bars, which he illustrated by drawings. He described the mode of piling, and the introduction of new iron. The form of the new pieces thus introduced could not be understood without engravings. A reference to the work of Valerius on the fabrication of Iron, exhibits a method somewhat analogous. Mr. S. stated that this establishment at Phœnixville was the only one, known to him, in the United States, where this very advantageous process had been introduced. In England and elsewhere, the usual method is to reduce the T rails, when worn, into the shape of flat bars, previous to piling and remanufacturing.

Prof. Cresson made a few remarks on the manufacture of Railway Bars, showing in what manner the hard and soft parts of the metal should be disposed to form the most perfect rail.

Prof. Cresson was requested to give some account of the late attempts to adapt locomotive engines to the use of anthracite as fuel. He stated that numerous contrivances for this purpose are now in course of trial on several of the railroads engaged in the transportation of this fuel to market, principally on the road from Philadelphia to Reading and Pottsville.

The chief difficulty in using anthracite in locomotives arises from the intensity of the local heat, when the combustion is at its height, by which the metal in contact with the fuel is rapidly destroyed. From the peculiar nature of the fuel, the tendency of the blast produced by the exhaust is to create a sort of unstable equilibrium in the action of the fire, or a tendency to excess on either side of the proper mean; thus the hotter the fire the higher the steam, and as this increases, the blast becomes sharper and the fire still more vehemently urged. Among the expedients heretofore tried for curing the evil, the most effectual have been the use of a blower instead of the exhaust blast, and a peculiar form of nozzle to the exhaust pipe, by which the force of the blast can be varied at will by the engineer. These have alleviated the difficulty, but not entirely cured it. The most recent scheme is that carried into practice by Mr. Mulhollend, the manager of the machine shops of the Philadelphia and Reading Railroad, which closely resembles one for which a caveat was filed in the Patent Office several years ago by Mr. M. W. Baldwin. It consists of two principal parts, one for shielding the fire-box by a stratum of coal in a state of imperfect combustion and consequent moderate heat, and the other for detaining and burning the gaseous carbonic oxide produced by the imperfect combustion of the coal. The first effect is obtained by having a broad plate or flanch of cast iron, placed around the fire grate

in contact with the walls of the fire-box. The part of the coal that rests on this shelf receives an insufficient supply of air for active combustion, and shields the iron of the boiler from the more active fire resting on the grate.

To provide for the detention and combustion of the carbonic oxide gas, the flues are made in two separate lengths, with a box or gas chamber interposed; the set of flues attached to the fire box being quite short and of larger calibre than usual, and those in the front end of the boiler of the usual diameter and nearly the usual length. Fresh air is admitted into the gas chamber from the ash pan, and the inflamed gas drawn through the forward flues by the blast of the exhaust. The only trouble experienced thus far in using these engines, is said to arise from the difficulty of keeping the short flues of large calibre perfectly steam tight, but it is believed that this will be removed by slightly diminishing their diameter, and that with this change, the results will be entirely satisfactory.

Mr. G. W. Smith, in compliance with his promise at the last meeting, gave some additional returns from the anthracite coal regions of Pennsylvania, which, added to those formerly given, presented a grand total of 5,100,000 tons mined in the State of Pennsylvania, during the last year, making an aggregate of bituminous and anthracite, of 7,500,000 tons nearly.

Mr. Smith requested the attention of the meeting to the necessity of Legislative enactments for the protection of buildings from fire; described the many disastrous conflagrations in Philadelphia, and other cities of the Union, with a comparative exemption of the cities of London and Paris; briefly described the mode of building prescribed by law in those cities, and the beneficial results therefrom; recommended the subject to the consideration of the Institute, by submitting the following resolution:

Resolved, That a committee be appointed to memorialize the Councils of the City of Philadelphia, to pass an ordinance to render buildings more secure against fire.

Mr. Fraley stated that by an Act of Assembly passed in the year 1832, full power had been given to the Corporation of the City of Philadelphia, to prohibit within the limits of said City, the erection of buildings of wood or other combustible materials. That it had also been empowered by the same act to fix and determine the height, thickness, and materials of the walls, and the general character of buildings thereafter to be erected in said city, with the special view of guarding, as far as might be possible, against the ravages and injuries of fire. He was not aware that any like power had been granted to the municipal corporations of the County of Philadelphia, and that therefore, the provision of the law, as it now stands, was only limited in its effect, and so far as he knew, had not yet been enforced in the city, further than to prohibit the erection of wooden and brick-paned buildings of a certain description. He hoped a strong expression of public opinion would now be made, calling upon the councils to execute the powers given to them by the act of 1832, and also upon the Legislature to extend them if necessary, and to make the law operative over the whole county.

On motion, the resolution was adopted, and the following gentlemen were appointed the

Committee.—Messrs. G. W. Smith, John C. Cresson, George Erety, John M'Clure, and Wm. T. Forsyth.

Alderman Geo. Erety remarked on the evils resulting from crowding small houses together in courts and blind alleys, at the expense of light, cleanliness, and ventilation, and offered the following resolution:

Resolved, That a Committee be appointed to ask from the Legislature, the passage of laws to secure such space and ventilation as will promote health, in houses built for dwellings, in the City and County of Philadelphia.

The subject was discussed by Messrs. Erety, Smith, Prof. Cresson, Dr. Turnbull, and Dr. Rand, when, on motion, the resolution was adopted, and the following gentlemen were appointed the

Committee.—Messrs. Geo. Erety, Dr. L. Turnbull, Dr. Isaac Parrish, John F. Frazer, and Dr. B. H. Rand.

Erratum.

In transcribing the results of experiments made with the burners proposed by Dr. Goddard, for microscopic observations, of which a statement was presented at the December monthly meeting of the Institute, the numbers representing the relative economy of light given by the burners were erroneously stated representing the standard candles to which the burners were severally equivalent. To correct this error, the subjoined table of consumption and equivalent candles is furnished by the committee which made the experiments:

Kind of Burner.	Consumption per hour.	Equivalent No. of candles.	Economy of Light.
Fishtail, .	5·7 cubic feet.	29·1	13·53 or 1·487
Goddard's, .	2·65 "	9·1	9·1 or 1·000
Second form of do.	2·75 "	10·4	9·92 or 1·090

The unequalled steadiness and uniformity of the two latter burners render them of great value for readers and microscopists.

BIBLIOGRAPHICAL NOTICE.

Bartol's Marine Boilers of the United States.

This little book is a collection of drawings of the boilers of the principal steamers, (64 in number,) constructed in this country; each drawing accompanied by a statement of the dimensions and draft of the vessel, the description and size of the engines, and of the side wheel or propeller; the average number of revolutions, pressure of steam, and point of expansion; the consumption of fuel, and a description of the boilers, with their heating and grate surfaces, relative areas of flues, chimney, &c.; the whole summed up by a calculation of the amount of water evaporated per pound of coal, and the consumption of coal per square foot of grate. Means are thus afforded for an accurate comparison of the different forms of boilers employed, the drawings and data being in all cases authentic.

As a concise statement of what has been done in America for the advancement of steam navigation, this book may be recommended to engineers. No pretensions are made to the establishment of theories. The author, strictly confining himself to facts, leaves his readers to draw their own inferences. M.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

MARCH, 1852.

CIVIL ENGINEERING.

*On the Preservation of Timber by Creosote.**

Wood may be briefly stated to be composed of a fibrous tissue, which, upon examination with the microscope, is found to consist of longitudinal tubes, arranged in concentric rings around the centre pith;—these tubes varying in diameter from $\frac{1}{2000}$th to $\frac{1}{200}$th part of an inch. The use of these tubes in a growing tree is to convey the sap from the root to the branches; and after the tree is cut up for use, they contain the chief constituent of the sap, vegetable albumen, a substance very much resembling in its composition animal albumen, or the white of an egg. Different woods vary in the proportion which they contain of this substance; but in the softer woods it averages one per cent.

The dry rot in timber is caused by the putrefaction of the vegetable albumen, to which change there is a great tendency; and when once this has taken place, it soon infects the woody fibre, inducing decomposition, and causing its entire destruction. Many plans have been employed to arrest this evil, each with more or less success,—the chief aim of the authors being to coagulate the albumen by means of metallic salts, and so prevent putrefaction. Among others may be mentioned the following, as being the most successful:—Kyan's process, by the use of chloride of mercury; Burnett's, by chloride of zinc; and Payne's, by sulphate of iron and muriate of lime, forming an insoluble precipitate in the pores of the wood. To each of these plans there are serious objections in practice. In the first place, when metallic salts are injected into timber in sufficient quantities to crystallize, the crystals force open the pores, causing a disruption of the fibre; and when the timber afterwards becomes wet, they dissolve, leaving large spaces for the lodgment of water, and rendering the timber much weaker. Secondly, the metallic salts being incapable of

* From the London Journal of Arts and Sciences, December, 1851.

sealing the pores of the wood, the fibre is still exposed to the action called eremacausis—a process of oxidation—after the albumen has been precipitated. These processes are also objectionable for wood that requires iron to be inserted in or attached to it, as the acids act upon the iron in a manner well known, and ultimately destroy it.

The plan that is the subject of the present paper is the one invented by Mr. Bethell, for the use of a material obtained by the distillation of coal tar. This material consists of a series of bituminous oils, combined with a portion of creosote: which latter substance is acknowledged to possess the most powerful antiseptic properties. The action of the material may be thus described: When injected into a piece of wood, the creosote coagulates the albumen, thus preventing the putrefactive decomposition; and the bituminous oils enter the whole of the capillary tubes, encasing the woody fibre as with a shield, and closing up the whole of the pores, so as entirely to exclude both water and air. The bituminous oils being insoluble in water, and unaffected by air, the process is thereby rendered applicable to any situation. So little is bituminous oil affected by atmospheric change, that the writer has seen wrought iron pipes that had merely been painted over with it, and laid in a light ground, one foot beneath the surface, taken up after twenty years, and they appeared and smelt then as fresh as when first laid down.

By using these bituminous oils, the most inferior timber, and that which would otherwise soonest decay, (from being more porous, and containing more sap, or being cut too young, or at the wrong season,) is rendered the most durable. This will be readily understood when it is considered that this porous wood will absorb a larger portion of the preserving material than the more close and hard woods: in fact, the soft woods are rendered hard by this process. By this means, therefore, engineers will be enabled to use a cheaper timber with greater advantage than they could use a more expensive timber uncreosoted; thus, taking the cost of a sleeper of American yellow pine at 4*s.*, and one of Scotch fir at 3*s.*, and then adding 1*s.* to the latter for creosoting, the two would be the same cost; but the former one would last, under the most favorable circumstances, not more than ten or twelve years; and the other would be good, under any circumstances, in all probability in a hundred years.

This system of preserving timber has been in use on several railways, and other works, for several years past. A portion of the London and North Western Railway, about seventeen miles in length, has been laid with the creosoted sleepers from nine to eleven years; during which period the engineer reports that no instance has occurred in which any decay has been detected in them, and they continue quite as sound as when first put down. On the Stockton and Darlington Railway, creosoted sleepers have also been laid for ten years, and are found to continue without any appearance of change or decay; also, on the Lancashire and Yorkshire Railway creosoted timber has been used for five years, as paving blocks, posts, &c.; the upper part has become very hard, and the part under ground appears as fresh as when taken out of the creosote tank, though the timber was of inferior, sappy quality. In a trial, commenced twelve years since, by Mr. Price, of Gloucester, of the comparative durability of timber in the covers of a melon pit, where it was exposed con-

stantly to the combined action of decomposing matter and the atmosphere, the unprepared timber became decayed in one year, and required replacing in a few years; a portion of the timber that had been Kyanized lasted well for about seven years, but then very slowly decayed; while the timber that had been creosoted still continues as sound as when first put down.

Not only does this creosoting process render wood free from decay, but it also preserves it from the attacks of the teredo worm, when used for ship building, harbors, docks, and other work contiguous to the sea. This has been satisfactorily proved at Lowestoft harbor, where the plan has had a very extensive trial for four years; and the superintendent reports that the uncreosoted piles have all been attacked by the limnoria and the teredo to a very great extent, and in some instances are eaten through; but there is no instance whatever of a creosoted pile being touched, either by the teredo or the limnoria; and all the creosoted piles are quite sound, though covered with vegetation, which generally attracts the teredo. This is to be accounted for by the creosote remaining intact in the timber, either wet or dry; and, being destructive to all animal life, it is proof against the attack of these parasites; whereas, with the other processes, the metallic salts are washed out, or that portion which unites with and coagulates the albumen is rendered quite innocuous by the process.

There are two processes in use by Mr. Bethell, for impregnating timber with creosote. One is by placing the wood in a strong iron cylinder, and exhausting the air from it, by an air pump, until a vacuum is created, equal to about twelve pounds on the square inch; the creosote is then allowed to flow into the cylinder, and afterwards a pressure is put upon the creosote, by a force pump, equal to about 150 pounds on the square inch; and the timber, on being taken out, is fit for use.

The second process consists in first placing the timber in a drying house, and passing the products of combustion through it; thereby not only drying the timber rapidly, but impregnating it, to a certain extent, with the volatile oily matter and creosote contained in the products given off from the fuel used to heat the house. When the timber is taken out of this house, it is at once immersed in hot creosote in an open tank, thus avoiding the use of a steam engine, or pumps.

Mr. Clift exhibited specimens of creosoted sleepers, which had been in use for ten years on the London and North Western Railway, near Manchester, and were still perfectly sound and unchanged; also specimens of creosoted piles from Lowestoft Harbor, which had been in the sea for four years, and continued quite fresh and sound, and without being touched by the worm; and specimens of similar piles uncreosoted, from the same situation, which were completely eaten away and honeycombed by the worm in the same period.

Mr. Bethell observed, that when he first began to preserve timber, he found that no pressure would get the creosote into it, owing to the presence of moisture in the pores; it therefore became necessary to adopt the system of drying the timber first; and, after fourteen days, he found that the wood lost three pounds in weight in every cubic foot: this was by the old process of drying. He then introduced the present drying house;

and, in twelve or fourteen hours, they lost eight pounds per cubic foot, in Scotch sleepers, which then absorbed an equal weight of creosote. An average of 11½ lbs. of creosote per cubic foot was now put into all the Memel timber at Leith harbor works; and it was forced in with a pressure of 180 lbs. per inch. One piece of creosoted timber had been observed at Lowestoft, which had been half cut through for a mortise, but not filled up again, and a teredo had penetrated a little way into it at that part, and then attempted to turn to the right, and then to the left, and had ultimately quitted the timber without proceeding any farther. Young wood was the most porous round the exterior, and consequently absorbed most creosote, which formed a shield to keep off the worm. The creosoted sleepers were better, after eight or ten years, than when new, because the creosote got consolidated in them, and rendered them harder. He had taken the idea originally from the Egyptian mummy; it was exactly the same process; any animal put into a creosote tank assumed the appearance and became in like condition to a mummy. Timber creosoted was now chiefly used in railways; but he believed that, if it was introduced into coal pits, it would be found that no timber so used in those places would rot.

The Chairman inquired whether, in the process of creosoting, the quantity of sap was calculated, and how the exact quantity of creosote that was put into the timber was ascertained.

Mr. Bethell replied, that every piece of timber was weighed before it was put into the creosote tank, and again when taken out; and each piece was required to be increased in weight, by the process, 10 lbs. per cubic foot. The quantity of oil used always rather exceeded the weight gained in the timber, on account of the loss of weight from the moisture extracted by the exhaustion of the air pump. He also remarked, in answer to another question from the Chairman, that oak only absorbed half as much creosote as Memel timber. Common fir creosoted would last double the time of hard wood creosoted, because it took more creosote. Beech made the best wood, being full of very minute pores; and they could force a greater quantity of creosote into beech than into any other wood; consequently it took a more uniform color throughout from the process. Long pieces of timber were found to require more time to saturate them in proportion to their length. The creosote appeared to enter at the two ends, and be forced up through the whole length of the pores; and the progress was known by the quantity of creosote forced into the tank after it was filled, according to the number of cubic feet of timber contained in the tank.

An Investigation of the Strains upon the Diagonals of Lattice-beams, with the resulting Formulæ. By W. T. Doyne, *Assoc. Inst. C. E., and* Prof. W. B. Blood.*

The experiments detailed in the paper were made on a model 12 feet in length, so constructed that the diagonals in compression (which were strips of mahogany, let into the top and bottom, but not fastened to them, and the ties, which were of hoop iron chains,) must of necessity take their

* From the London Journal of Arts and Sciences, December, 1851.

respective bearing and strain; and by the substitution of a dynamometer for any one of the ties, the strain on it could be accurately measured.

The results of the investigation (which were given in a table, showing a remarkable coincidence between the strains as measured and calculated) were, that for a parallel beam of one span, supported at each end and loaded at the centre, the strains throughout the diagonals were uniform, and the horizontal strains were greatest at the centre, decreasing uniformly at the points of support. For a similar beam, uniformly loaded over its entire length, the strains on the diagonals commenced at the centre, increasing uniformly to the points of support; while the horizontal strains decreased from the centre to the ends, in the ratio of the ordinates of a parabola. These results were arrived at by different methods of reasoning, and the formulæ derived from them were stated to be applicable to the more complex form of a closely intersected lattice, taking into consideration the increased number of triangulations.—*Proc. Inst. Civ. Eng.*

On the Discharge of Water over Weirs and Overfalls. By Thomas Evans Blackwell, *M. Inst. C. E.**

[Paper read at the Institution of Civil Engineers, May 6, 1851.]

The establishment of certain natural laws in hydraulics has occupied the attention of philosophers from the days of Galileo to the present time, and although the great principles which now form the groundwork of modern hydraulic science are indisputably settled, yet much remains to be done by practical men, towards applying the necessary corrections for special circumstances; this is only to be accomplished by a faithful record of facts, and in engineering there is perhaps scarcely a branch where there is a greater want of them than in that of hydrodynamics.

This deficiency was particularly felt by the author of this paper, in the case of weirs or overfalls, established, by order of Parliament, for regulating and measuring the flow of water into a canal; and, as frequent doubts and disputes had arisen, the following experiments were undertaken for determining, by absolute trials, the discharge that might be expected from such orifices; and, as the opportunities for making such experiments are not of frequent occurrence, the results were carefully recorded, in order to submit them in detail for the consideration of the Institution.

The first set consists of a series of 243 experiments, made on overfalls of 3 feet, 6 feet, and 10 feet in width, with heads from 1 inch to 14 inches, and with the varying circumstances of having, for the overfall bar,—1st, a thin plate; 2d, a plank 2 inches thick; and, 3d, a crest 3 feet in breadth. These were all made on the Kennet and Avon Canal, in July, 1850.

The second set was made in conjunction with Mr. Simpson (V. P. Inst. C. E.), who has kindly permitted the results to be placed on record. The series consists of about 70 experiments, made on an overfall of about 10 feet in width. These were made at Chew Magna, Somerset, also in the summer of 1850. Although in some respects, as being made over a

* From the London Architect for January, 1852.

bar 2 inches thick and 10 feet long, many of the experiments are apparently parallel in both cases, they must be separately considered, on account of some peculiar circumstances which will be stated. Before considering these experiments in detail, it may be well to review, briefly, some of those previously ma deby English and Continental observers, and the practical deductions which had been arrived at by the writers on this subject.

Fig. 1. Plan.—Scale, 40 feet to 1 inch.

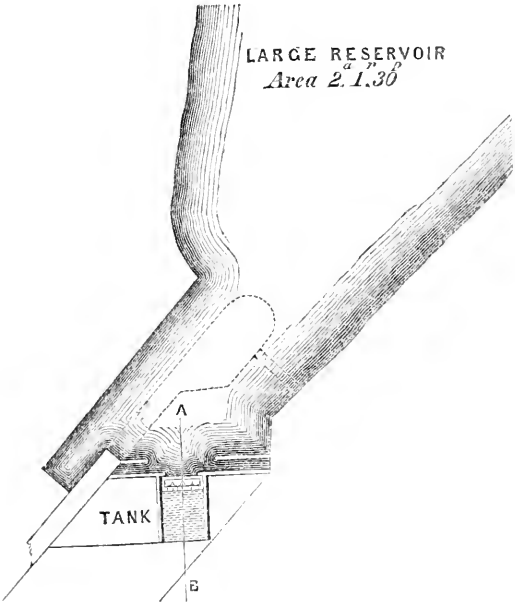
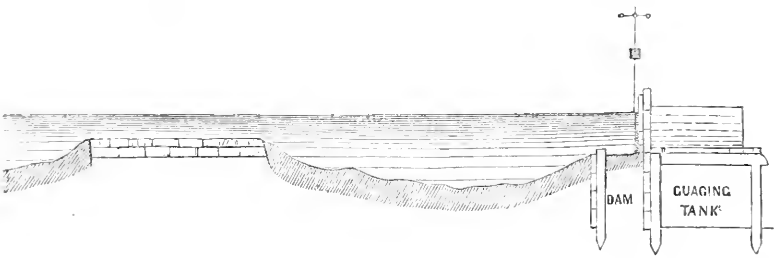


Fig. 2. Section on the line A B.—Scale, 8 feet to ¾ inch.



The most scientific series of experiments on the discharge of fluids through orifices have been made by foreign observers, and their labors must be familiar to hydraulic engineers; but the Chevalier Du Buat, Eytelwein, MM. D'Aubuisson and Castel, and MM. Poncelet and Lesbros, have made the principal observations on the passage of water over weirs.

Those of Du Buat, in 1779, were but few in number, and were on overfalls of $18\frac{3}{4}$ inches wide, and an extreme depth of $6\frac{3}{4}$ inches.

In 1827 and 1828, MM. Poncelet and Lesbros made a very elaborate series of experiments, on the discharge of water by rectangular orifices. They were conducted in the fortifications at Metz. Of these, only thirty-six related to overfalls, or 'deversoirs.' The head of water was varied from about $\frac{3}{4}$-inch up to 8 inches, and the width was constantly about $7\frac{3}{4}$ inches. They found that the coefficient for contraction was constantly varying, as the head was increased or diminished.

In 1834, MM. D'Aubuisson and Castel made a series of experiments, at the Toulouse water-works, with overfalls which discharged water from a rectangular canal $29\frac{3}{4}$ inches wide, and of variable depth. The widths of the apertures ranged upwards to the full width, and the head varied from about 1 inch to 8 inches.

Messrs. Smeaton and Brindley conducted a set of experiments, made over a waste-board of the width of 6 inches, and from 1 inch up to 6 inches deep. These, and the experiments of Dr. Robison, quoted in the *Encyclopædia Britannica*, appear to be the principal observations made and published in this country.

A comparison of the results of the foregoing experiments, and the coefficients applicable to them and to the present experiments, is given in the Appendix.

The Kennet and Avon Canal experiments were made on a reservoir, or side pond, measuring 2 acres, 1 rood, 30 poles, or 106,200 square feet in area, with a lock at each end, so that there was not any current. The weather was uniformly fine, and during six-sevenths of the time, the wind was very slight, blowing somewhat diagonally up stream, or against the course of the overfall; during one day the wind was more rough, blowing exactly down the stream; such of the experiments, made on that day, as are given in the tables, and are used in the calculations, are reduced to the standard of the others; a means of doing so being presented, by exactly parallel experiments, made on the more favorable days. It may not be uninteresting to know, that the coefficient of correction was found to be about 5 per cent.

The form of the overfall, and its relative size and position on the reservoir, will be understood by reference to figs. 1 and 2, and the object in presenting this memoir being to give an accurate record of facts, which may be of practical utility, it is necessary to point out two or three special circumstances, which may possibly, to some slight extent, have influenced the discharge, though the observations made during the progress of the experiments, would induce the belief that such influence was very small. The first is, that the water supplied from the reservoir above the one on which the experiments were made, did not feed exactly in the same proportion as it was taken out; it was let in by the upper lock, three or four times a day, or as often as was requisite. The area of the reservoir, however, was so large (106,200 square feet), that the difference of head between the beginning and the end of any one experiment, could scarcely be perceived. The second feature is, that at some little distance above the overfall, the depth of water was reduced, by a submerged course of masonry, belonging to the dock in which the trials were made,

and which rose to within 18 or 20 inches of the surface. The third feature is, that the overfall was placed on the outer line of the dam, so as to obtain the requisite fall, and was not exactly in the line of one of the sides of the reservoir. These are circumstances which could not have been conveniently altered, without considerably increasing the expense of the experiments, and as the approach to the overfall was at least 40 feet wide, it was thought that the general arrangements would fairly represent the case of discharge of water by an overfall from a large still reservoir.

Every care was taken to determine correctly the head of water acting in each experiment, and by such head is meant, throughout this paper, the total depth from the surface of the still water to the crest of the bar of the overfall. The bar forming the top of the overfall was made to rise or fall, and could be very accurately adjusted, by means of a hand-screw at each end; to this bar, which was about 12 feet in length and 2 feet deep, were fixed two gauge-rods, working in grooves, cut in a transverse beam above. The head having been determined on, the crest of the bar was brought exactly level with the still water in the reservoir; the line where the gauge-rods cut the top of the groove was marked with a pencil, and the required head was also measured and marked off on the gauge-rod. A man at each end then lowered the overfall bar down to the given head; the water was allowed to run through the waste trunk, till it had assumed an uniform regime, when, at a given signal, the lid covering the gauging tank was raised, and the time of filling the tank to a given height was accurately observed. The time was kept by two and sometimes by three assistants, and it was registered to quarter seconds. The particular mode of obtaining the head was in some degree a matter of necessity, arising from the desire to avoid the waste of water out of the canal, in the larger experiments.

The gauging tank had a floor of brick, laid in cement, with plank sides, and was carefully measured; its total capacity was 444·39 cubic feet; in the experiments with very small heads, it was only filled to a certain height; whatever leakage there was into the gauging tank, during some of the experiments, was measured in a separate vessel, and in the tables of experiments correction is made for this, in taking the quantity discharged during each experiment.

The thin plate, mentioned in some of the experiments as forming the overfall bar, was a piece of iron fender plate, barely $\frac{1}{16}$-inch thick; the plank, 2 inches thick, was square on the top, and the broad crest used was an apron formed of deal boards, roughly planed over, and fastened on to the outer edges of the plank, so as to form an uninterrupted continuation of it; the object in this case was to approximate towards a well constructed wide-crested weir, such as is found in rivers, &c.

The experiments tried in conjunction with Mr. Simpson, at Chew Magna, were made on a very small reservoir, which was kept constantly supplied by a pipe 2 feet in diameter, discharging from an upper reservoir, under a pressure of nearly 19 feet; the weather was generally fine, sometimes rather windy, but as the place was well sheltered by high walls, the effect of this was not much felt. In consequence of the distance between the discharge pipe and the overfall being comparatively short, (about 100 feet,) the water must have retained some part of the velocity

due to its discharge under so great a head; this was perceptible to the eye, in heads above 5 or 6 inches, but the peculiar form of the reservoir prevented the amount being accurately determined. The results, however, show that this influence must have been considerable, and that the effect of water approaching an overfall with an initial velocity is an element which should never be disregarded.

Fig 3. Plan.—Scale, 40 feet to 1 inch.

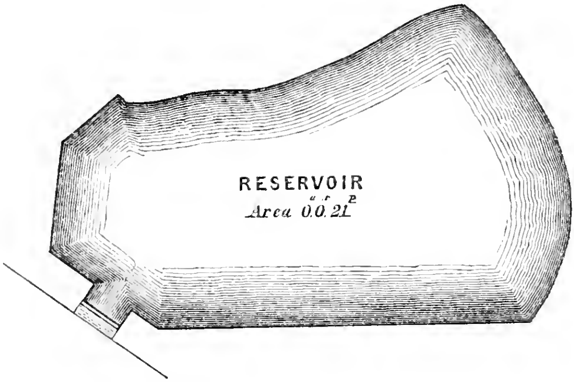
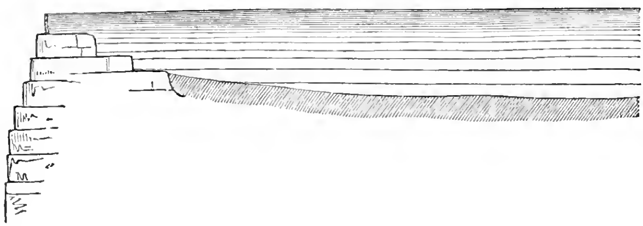


Fig. 4. Section through Overfall.—Scale, 8 feet to 1 inch.



The form of this overfall reservoir is shown in figs. 3 and 4. It had wings placed at an angle of 45°, well adapted for facilitating the discharge, and the overfall bar was a cast iron plate 2 inches thick, with a square top. The heads were measured on a bar 4 feet long, so placed diagonally in the still water that its zero was just level with the overfall top, and its upper end was raised 1 foot above. It was divided into twelve parts, which represented inches, and was again subdivided, so that each part was magnified four times, and one-sixteenth of an inch could be easily read. It was protected by a fender from the oscillations of the small waves in the reservoir. The time was kept by three and sometimes by four observers, who differed but little in their registers, of which a mean was taken. The gauging tank was a very good one, constructed for the purpose, of brick in cement, and built to hold 400 cubic feet; but by accurate admeasurement it was found to contain 389·79 cubic feet, and this quantity is used in the calculations. In this, as in the former set of experiments, efficient means, which it is not necessary to detail, were used for conveying the water from the overfall to the tank, for registering the leakage, &c.

Proceeding, then, to an explanation of the tables, it may be remarked, that the observations have been classified under the several descriptions, viz: over a plank 2 inches thick, with square edges; over a thin plate; over a crest, resembling the top of a weir, of which the breadth was 3 feet, the position of the surfaces horizontal, and also at inclinations, downwards, of 1 in 18, and 1 in 12 respectively. These main divisions were observed throughout, and the lengths of the weirs were severally 3 feet, 6 feet, and 10 feet. The first column in the table of experiments shows the head, or difference of level between the top of the overfall bar, or crest, and the level of the still water in the reservoir. The second column shows the duration of the experiment in seconds. The third column shows the absolute quantity of water discharged during the experiment, correction having been made for the leakage if any occurred. The fourth column is the reduction of the two preceding columns into cubic feet per second. The fifth is the reduction of the several results of similar experiments, with the same head and length, as shown in the former column, to an average of cubic feet per second. The sixth is a reduction of the discharge, so ascertained, into cubic feet per second, for each foot of width. The seventh column contains the coefficient of correction (m), deduced from the experiments and applicable to the formula—

$$Q = \sqrt{2gH} \times lH \times m \qquad . \qquad . \qquad . \qquad \text{(I.)}$$

in which Q is the discharge in cubic feet per second; $\sqrt{2g} = 8{\cdot}03$; H, the head in feet; l, the width of the overfall; and m, the coefficient of correction.

The eighth column contains the coefficient of correction (k), deduced also from the experiments and applicable to the formula*—

$$H^{\frac{3}{2}} \times l \times k. \qquad . \qquad . \qquad . \qquad . \qquad . \qquad \text{(II.)}$$

in which Q is the discharge in cubic feet per second; l, the width of the overfall in feet; H, the head in inches, or the height of the still water in the reservoir, above the crest of the overfall.

[Two columns, numbered respectively 9 and 10, were given in Mr. Blackwell's paper; but the particulars recorded not being taken in all the experiments, we have thought proper to omit them; the following may, however, be stated as the results arrived at in those which were observed]:—First, that the head of water, above an overfall, may be ascertained approximately, but only so, by the insertion of a 2-foot rule, held against the stream on the overfall bar, and observing the height to which the water rises, as the total head above the crest. Secondly, that the thickness of the blade of water, relatively to the total head, was much less than that which Du Buat assumed, in the theory on which his formula was based; which was, that this thickness was equal to half the total depth, from the crest to the top of the water. Indeed, it much more nearly agreed with the results which Professor Robison has recorded, and which he gives as about five-sevenths of the total depth. In the present experiments, it was found that, in the case of the plank overfall 2 inches wide, the thickness

*This formula is the same as that in general use among English engineers, viz: $D = H^{\frac{3}{2}} \times 5{\cdot}1$, in which D is the number of cubic feet discharged per minute for every foot in width of the overfall. H, the head in inches. 5·1 the *constant* coefficient of reduction. (The *variable* value of the coefficient (k) is, however, shown in these experiments.)

varied from six-tenths to eight-tenths, following the law of increase, as the total head increased. The exact ratios are inserted in the tables of experiments. In each of these cases, the admeasurement was taken at the outer edge of the bar, or at the lower end of the apron.

With a view of ascertaining how nearly the discharges of water follow the natural parabolic law, several curves were projected, in which the abscissæ represented the quantities discharged per second, under the various heads shown by the corresponding ordinates. From these it was seen, that though they evidently followed the fundamental law, yet the various opposing forces called into play, as the heads and widths increased or decreased, produced anomalies and variations from that curve, which entirely destroyed its regularity.

The whole of the coefficients given in the tables have been plotted, in such a manner as to show the mean coefficient for each set of experiments, and the variations for each change of head. This method shows in a striking manner, that no formula with a constant coefficient will give the true discharge of water by a weir. It is also interesting to observe, that whereas, in some instances, the coefficient is higher with a small head, and decreases as the head increases, in others the reverse takes place. Thus it will be seen, that where the overfall bar was a piece of thin plate, with a head of 1 inch, the coefficient was considerably higher than the mean; whilst a similar length of overfall, consisting of a plank 2 inches wide, gives the coefficient as much less than the mean; again, whilst the coefficient for an overfall formed of a plank 2 inches wide and 3 feet long, with a head of 1 inch, gives a coefficient of ·331, the same head and length of crest of 3 feet, gives only ·301 as a coefficient.

Experiments on Overfalls, Kennet and Avon Canal.

Overfall.	Total Depth of Water above Crest, in inches.	Time in seconds.	Cubic Feet Discharged.				Coefficients.	
			Total Quantity.	Per Second.	Average per Second.	Per second for 1 foot in width.	m	k
Table I.—A thin Plate, 3 ft. long.	1	176½	45·97	·260	·260	·087	·451	·087
	2	124½	91·94	·739	·739	·246	·450	·087
	3	72¾	91·94	1·264	1·264	·421	·420	·081
	4	96	182·94	1·906	1·906	·635	·411	·079
	5	99½	259·01	2·603	2·603	·868	·401	·078
	6	131¼	441·77	3·366	3·366	1·122	·395	·076
						Mean	·421	·080
Table II.—A thin Plate, 10 ft. long.	1	177¼	183·90	1·038	1·038	·104	·539	·104
	2	63	183·90	2·920	2·920	·292	·535	·102
	3	103¼	444·39	4·304				
	3	62	260·50	4·201	4·286	·429	·428	·082
	3	42¼	183·90	4·352				
	4	65½	442·43	6·755	6·755	·675	·437	·089
	5	47¼	442·03	9·355	9·355	·935	·433	·083
	5	47¼	442·03	9·355				
	8	26	441·77	16·988	16·909	1·691	·387	·075
	8	26¼	441·77	16·830				
	9	24	441·99	18·416	18·416	1·812	·353	·069
						Mean	·415	·086

Experiments on Overfalls, Kennet and Avon Canal. (Continued.)

Overfall.	Total Depth of Water above Crest, in inches	Time in seconds.	Cubic Feet Discharged. Total Quantity.	Per Second.	Average per Second.	Per second for 1 foot in width.	Coefficients. m	k
Table III.—Plank, 2 inches wide, 3 feet long.	1	757	137·91	·181	·180	·060	·311	·060
	1	280¾	45·97	·164				
	1	235	45·97	·195				
	2	167	91·94	·550	·555	·185	·339	·065
	2	161	91·94	·561				
	3	159	183·90	1·157	1·138	·376	·375	·072
	3	82½	91·94	1·114				
	3	80½	91·94	1·143				
	4	147½	259·00	1·756	1·695	·565	·366	·071
	4	158½	258·92	1·634				
	5	172½	442·67	2·566	2·537	·846	·392	·076
	5	176½	442·63	2·508				
	6	131½	443·07	3·370	3·363	1·121	·395	·076
	6	132	443·07	3·356				
	7	100½	442·38	4·402	4·413	1·471	·411	·074
	7	100	442·39	4·424				
	8	83½	442·30	5·297	5·297	1·766	·404	·078
	8	83½	442·30	5·297				
	9	70¾	442·62	6·256	6·256	2·085	·400	·077
	10	58¾	442·92	7·539	7·492	2·497	·409	·079
	10	59½	442·99	7·445				
						Mean	·380	·073
Table IV.—Plank, 2 inches thick, 6 feet long.	1 to $1\frac{5}{16}$	487½	171·23	·354	·354	·059	·306	·059
	2	137½	184·34	1·317	1·222	·204	·374	·072
	2	159	179·76	1·128				
	3	184½	439·60	2·383	2·396	·399	·398	·077
	3	183½	439·62	2·396				
	3	184	439·61	2·389				
	3	183½	439·62	2·396				
	3	181½	439·68	2·422				
	3	184	439·61	2·389				
	4	127	439·31	3·463	3·563	·594	·383	·074
	4	120	439·60	3·663				
	5	82½	442·24	5·359	5·209	·868	·401	·078
	5	86¼	442·15	5·126				
	5	86	442·16	5·141				
	6	64¼	442·72	6·890	6·890	1·150	·405	·074
	6	64¼	442·72	6·890				
	7	49¼	443·11	8·997	8·695	1·449	·405	·073
	7	51½	443·06	8·631				
	7	52	443·04	8·520				
	7	51½	443·06	3·631				
	8	43	443·27	10·309	10·309	1·718	·393	·076
	8	43	443·27	10·309				
	9	37½	443·41	11·850	11·850	1·975	·379	·073
	9	37½	443·41	11·850				
	9	37½	443·41	11·850				
	10	34¼	443·03	12·950	13·156	2·193	·359	·069
	10	33¼	443·07	13·363				
	12	26¾	443·32	16·515	16·356	2·726	·350	·066
	12	27¼	443·30	16·207				
	14	20¼	443·58	21·890	22·183	3·697	·366	·071
	14	19¾	443·60	22·477				
						Mean	·377	·072

Experiments on Overfalls, Kennet and Avon Canal. (Continued.)

Overfall.	Total Depth of Water above Crest, in inches.	Time in seconds.	Cubic Feet Discharged. Total Quantity.	Per Second.	Average per second.	Per second for 1 foot in width.	Coefficients. m	k
Table V.—Plank, 2 inches thick, 10 feet long.	1	230	152·62	·665	·563	·056	·290	·056
	1	454¾	207·30	·461				
	2	81½	172·82	2·125	2·129	·213	·390	·075
	2	81	172·89	2·134				
	3	47	177·51	3·777	3·803	·380	·379	·073
	3	46	177·65	3·862				
	3	48	177·38	3·695				
	3	111¼	431·38	3·877				
	4	67¼	436·53	6·491	6·192	·619	·401	·077
	4	67½	436·50	6·468				
	4	72¾	440·76	6·059				
	4	73½	440·72	5·996				
	4	73	440·74	6·038				
	4	73¼	440·73	6·098				
	5	48¾	438·69	8·998	8·774	·887	·406	·078
	5	50¼	438·52	8·726				
	5	51	438·43	8·597				
	6	41¾	438·72	10·512	10·881	1·088	·384	·074
	6	40	438·95	10·976				
	6	40	438·95	10·976				
	6	39¾	439·74	11·063	11·063	1·106	·384	
	7	32¼	440·01	13·780	13·720	1·372	·384	·074
	7	33¾	439·80	13·164				
	7	32	440·04	13·887				
	7	32	440·65	13·885				
	7	32	440·65	13·885				
	8	28¾	440·48	15·474	15·943	1·594	·365	·071
	8	27	440·12	16·463				
	8	28	440·59	15·993				
	9	22½	441·33	19·613	19·417	1·942	·372	·072
	9	23¾	441·16	18·575				
	9	22	441·40	20·063				
	10	20	441·67	22·083	21·737	2·174	·356	·069
	10	21	441·54	21·026				
	10	20	442·05	22·102				
	12	15½	442·29	28·529	28·529	2·853	·356	·069
						Mean	·371	·072
VI. Plank, 2 in. wide, 10 ft. long.*	5	45¾	442·11	9·664		0·966	·447	·086
	4	65½	441·77	6·745		0·674	·437	·088
	2	106	260·50	2·460		0·246	·450	·087
	1	190	183·90	0·969		0·097	·503	·097
						Mean	·459	·090
VII. Crest, 3 ft. wide, 3 ft. long, slope 1 in 12	1	254½	45·97	·181	·181	·060	·311	·300
	2	236¾	137·91	·582	·582	·194	·355	·069
	3	170¼	183·90	1·080	1·080	·360	·359	·069
	4	188½	257·75	1·404	1·404	·468	·303	·0585
	6	146½	441·46	3·014	3·014	1·005	·354	·068
	7	117½	442·04	3·762	3·762	1·254	·351	·068
	9	85¼	442·26	5·188	5·188	1·729	·332	·064
						Mean	·338	·065

* With wing-boards converging at an angle of 64°.

Experiments on Overfalls, Kennet and Avon Canal. (Continued.)

Overfall.	Total Depth of Water above Crest, in inches.	Time in seconds.	Cubic Feet Discharged. Total Quantity.	Per Second.	Average per second.	Per second for 1 foot in width.	Coefficients. m	k
VIII. Crest, 3 ft. wide, 3 ft. long, sloping 1 in 18.	1	218¾	45·97	·210	·210	·070	·363	·070
	2	230¾	137·91	·597	·597	·199	·364	·070
	3	170¾	183·90	1·077	1·077	·359	·358	·069
	4	194	257·58	1·328	1·328	·443	·287	·055
	5	197½	440·44	2·230	2·230	·743	·344	·066
	7	120½	441·98	3·667	3·667	1·222	·342	·066
	8	103¼	441·81	4·279	4·279	1·426	·327	·063
	9	86½	442·23	5·112	5·127	1·709	·328	·063
	9	86	442·24	5·143				
						Mean	·339	·065
IX. Crest, 10 ft. long, 3 ft. wide, sloping 1 in 18.	1 to ⅞	282	169·80	·603	·603	·060	·311	·060
	2	138¼	253·59	1·834	1·805	·181	·330	·064
	2	100½	178·88	1·777				
	4	83	440·24	5·304	5·304	·530	·343	·066
	6	43	442·24	10·285	10·285	1·028	·362	·070
	8	30	442·89	14·761	14·761	1·476	·338	·066
						Mean	·337	·065
X. Crest, 3 ft. wide, level, and 3 feet long.	1	265½	45·97	·173	·173	·058	·301	·058
	2	350	183·90	·525	·525	·175	·321	·062
	3	294	260·50	·886	·886	·295	·294	·057
	4	200	258·50	1·292	1·292	·431	·279	·054
	5	213½	441·19	2·066	2·066	·689	·319	·061
	6	158	441·23	2·892	2·840	·947	·334	·064
	6	65½	182·59	2·788				
	7	126¾	441·86	3·486	3·486	1·162	·325	·060
	7⅞, 8	108	441·69	4·089				
	8	107½	441·71	4·109	4·109	1·369	·313	·061
	9	89¾	442·15	4·926	4·926	1·642	·317	·061
						Mean	·311	·060
XI. Crest, 3 ft. wide, level, and 6 ft. long.	1 to 1¼	405	173·37	·429	·429	·071		
	3	222¼	438·52	1·973				
	3	223¾	438·58	1·961	1·971	·329	·328	·063
	3	221¾	438·63	1·978				
	4	142	438·72	3·019	3·068	·511	·331	·064
	4	144	438·64	3·045				
	6	77½	442·38	5·781	5·781	·963	·008	
	7	61¾	441·61	7·150	7·150	1·191	·331	·060
	9	44½	443·24	9·964	10·019	1·670		
	9	44	443·25	10·074				
	0	39	442·84	11·360	11·360	1·895	·310	·060
	0	39	442·84	11·360				
	2	29¾	443·21	14·900	14·965	2·495	·311	·060
	2	29½	443·21	15·030				
						Mean	·322	·061
XII. Crest, 3 ft. wide, level, and 10 ft. long.	1	339½	166·93	·092	·492	·049	·254	·049
	2	101½	178·83	1·762	1·736	·174	·319	·061
	2	104½	178·68	1·710				
	5	59¼	441·43	7·450	7·450	·745	·345	·066
	6	45½	442·12	9·717	9·717	·972	·342	·066
	8	32½	442·77	13·622	13·622	1·362	·312	·060
	9	26¼	443·08	16·879	16·879	1·688	·324	·063
	10	24	443·19	18·467	18·467	1·847	·303	·059
						Mean	·314	·061

Table XIII.—Experiments on Overfalls, Chew Magna.

Overfall Bar, 2 inches wide, 10 feet long.

Total Depth of Water above Crest, in inches.	Time in seconds.	Cubic Feet Discharged.				Coefficients.	
		Total Quantity.	Per Second.	Average per second.	Per second for 1 foot in width.	m	k
1 to $\frac{7}{8}$	$560\frac{1}{2}$	384·71	·690	·690	·069	·394	
1 to $1\frac{1}{16}$ b	469	384·71	·820				
$1\frac{1}{16}$ bare	439	384·71	·870	·860	·086	·417	
$1\frac{1}{16}$ good	$434\frac{1}{2}$	384·71	·880				
$2\frac{3}{16}$	$139\frac{1}{4}$	398·79	2·900	2·900	·290	·455	
$2\frac{1}{4}$	$133\frac{3}{4}$	385·79	2·900				
$2\frac{3}{4}$ good	$98\frac{1}{4}$	383·71	3·906	3·906	·391	·443	
$2\frac{25}{32}$	98	383·71	3·916				
$2\frac{25}{32}$	$97\frac{1}{2}$	383·71	3·916				
$2\frac{25}{32}$	$97\frac{1}{4}$	383·71	3·950	4·016	·402	·447	
$2\frac{25}{32}$	$97\frac{1}{2}$	383·71	4·104				
$2\frac{25}{32}$	$97\frac{1}{2}$	383·71	4·104				
$2\frac{25}{32}$	$97\frac{1}{2}$	383·71	4·104				
$2\frac{7}{8}$	$93\frac{1}{4}$	383·71	4·115	4·115	·412	·437	
$2\frac{29}{32}$	$92\frac{1}{2}$	383·71	4·148	4·148	·415	·435	
$2\frac{15}{16}$	$94\frac{1}{4}$	398·79	4·231	4·231	·423	·436	
3 bare	82	385·71	4·700	4·700	·470	·469	
3 to $3\frac{1}{16}$	80	385·71	4·820	4·820	·482	·483	
4 bare	$52\frac{1}{2}$	385·71	7·340	7·340	·734		
4	50	385·71	7·710				
4	50	385·71	7·710	7·680	·768	·497	
4	$50\frac{1}{2}$	384·71	7·620				
$4\frac{1}{4}$	46	383·71	8·342				
$4\frac{1}{4}$	46	383·71	8·342	8·358	·836	·495	
$4\frac{1}{4}$	$45\frac{3}{4}$	383·71	8·390				
$4\frac{5}{16}$	45	383·71	8·530				
$4\frac{5}{16}$	$44\frac{1}{4}$	387·75	8·770				
$4\frac{5}{16}$	$43\frac{1}{2}$	386·71	8·890	8·770	·877	·507	
$4\frac{5}{16}$	$43\frac{1}{2}$	386·71	8·890				
$4\frac{3}{8}$	44	383·71	8·721	8·721	·872	·494	
$4\frac{7}{16}$	$41\frac{3}{4}$	383·71	9·190				
$4\frac{7}{16}$	$42\frac{1}{4}$	383·71	9·090	9·017	·902	·500	
$4\frac{7}{16}$	$43\frac{1}{2}$	385·71	8·870				
$4\frac{7}{16}$	$43\frac{1}{4}$	385·71	8·920				
$4\frac{1}{2}$ bare	$43\frac{3}{4}$	385·71	8·820				
$4\frac{1}{4}$ bare	$43\frac{1}{2}$	385·71	8·870	8·887	·889	·483	
$4\frac{1}{4}$ bare	43	385·71	8·970				
5 bare	34	383·71	11·290	11·290	1·129	·520	
$5\frac{5}{16}$	$33\frac{1}{2}$	383·71	11·460	11·460	1·146	·521	
$5\frac{13}{32}$	$31\frac{3}{4}$	383·71	12·086	12·086	1·209	·499	
$5\frac{7}{16}$ to $5\frac{15}{32}$	31	383·71	12·380	12·380	1·238	·501	
	31	383·71	12·380				
$5\frac{15}{16}$	$28\frac{1}{4}$	385·71	13·530	13·530	1·353	·485	

TABLE XIII.—EXPERIMENTS ON OVERFALLS, CHEW MAGNA. (Continued.)

Total Depth of Water above Crest, in inches.	Time in seconds.	Cubic Feet Discharged.				Coefficients.	
		Total Quantity.	Per Second.	Average per second.	Per second for 1 foot in width.	m	k
6	$27\frac{1}{4}$	385·71	14·150	14·150	1·415	·499	
6	$27\frac{1}{4}$	385·71	14·150				
$6\frac{3}{16}$	$28\frac{1}{2}$	399·79	14·030	14·030	1·403		
$6\frac{3}{16}$	$27\frac{3}{4}$	398·79	14·370	14·03 0	1·443	·499	
$6\frac{3}{16}$	$27\frac{1}{2}$	398·79	14·500				
$6\frac{3}{16}$ to $6\frac{1}{4}$	$26\frac{3}{4}$	399·79	14·900	14·900	1·490	·498	
$6\frac{15}{16}$	$21\frac{1}{4}$	385·71	18·150	18·150	1·815	·515	
$6\frac{15}{16}$	$21\frac{1}{4}$	385·71	18·150				
$7\frac{21}{32}$	$20\frac{1}{2}$	398·79	19·450				
$7\frac{21}{32}$	$20\frac{1}{4}$	398·79	19·690	19·610	1·961	·478	
$7\frac{21}{32}$	$20\frac{1}{4}$	399·30	19·690				
8	$16\frac{1}{2}$	385·71	23·380	23·380	2·338	·535	
8	$16\frac{1}{2}$	385·71	23·380				
8 to $8\frac{3}{16}$	$15\frac{1}{2}$	384·71	24·820	24·820	2·482	·491	
$8\frac{5}{16}$	$15\frac{1}{2}$	384·71	24·820	24·820	2·482	·500	
9	14	385·71	27·550				
9				27·550	2·755	·521	
9		383·71	27·550				
					Mean	·480	

The first twelve tables give the results of the experiments made on the Kennet and Avon Canal, where the reservoir was large, in proportion to the overfall, and the water was still.

Table XIII. contains the results of the experiments made at Chew Magna, in Somersetshire, in which the reservoir was very small, in proportion to the overfall, and it was kept continually supplied by a pipe 2 feet in diameter, leading from a reservoir 19 feet above it. The columns, in this case also, have the same signification as those relating to the experiments on the Kennet and Avon Canal.

(To be Continued.)

For the Journal of the Franklin Institute.

Notice of a Railroad upon an Ice Grade. By ELLWOOD MORRIS, *Civil Engineer.*

The railroad lately laid upon a graduation of ice, provided by nature across the mouth of the Susquehanna river, at Havre de Grace, in the State of Maryland, seems to deserve a more permanent record than the fleeting notices of the daily press.

It adds another to the many striking evidences recently afforded, of the promptitude with which the mind of the American engineer and mechanic grapples with unexpected difficulties, and triumphs over them.

The railroad uniting the cities of Baltimore and Philadelphia, touches both banks of the Susquehanna river at its mouth.

The river here is about four-fifths of a mile in width, and forming a break in the railroad of that length, over deep water; the communication is usually kept up by means of a large steam ferry boat, upon which the passengers cross from one bank to the other, independent trains with their locomotives being in waiting upon both banks.

The passengers themselves debark, when they reach the river, and gain the boat through covered buildings, which screen them from the weather; their baggage, with the car containing it, is run upon the upper deck, and being carried over is replaced upon the railway on the further bank, and coupled to the train in waiting there.

Now the river Susquehanna, leading to the north, in bleak and mountainous regions, brings down in the winter season, great quantities of floating ice, which seriously impede the railroad ferry.

At the mouth of the river there is shoal water, in which the ice grounds, and in severe weather, it forms a point of support for successive floating masses, until it sometimes gorges up for many miles above the ferry of the railway line.

In forming these "*gorges*" of ice, the cakes edge up, and freezing together in that position, form a mass of great solidity and strength, but very rough upon the surface.

While this gorge is forming, the railroad ferry is necessarily discontinued, and when it has formed, the question arises—how is the business of the railway to be resumed?

These preliminary remarks bring us now to our main subject: In a severe winter like that of 1851-2, the engineer of the railway sees his ferry line at Havre de Grace cut off, and the river filled almost to the bottom with a vast accumulation of cakes of ice, a foot thick, edged up, and frozen in that position, so as to present a mass of great strength, but most forbidding superficial aspect.

Contemplating this with the true eye of science, and seeing its adaptation to his purpose, Mr. Trimble, the engineer of the railroad company, determined to form over this rude glacier, *a railroad* for his baggage and freight cars, and *a sledge road* along side of it, upon which two horse sleighs could carry his passengers, and by means of towing lines, propel the freight cars over the river. This was the great idea, and most promptly and successfully has it been carried out.

The first step was to *locate* the railroad; for upon this rough surface of ice, a straight line between the ferry landings, would have required too much graduation; too much excavation and embankment, (so to speak,) of ice and snow.

The line was accordingly staked out with several curves, so as to reduce the labor required in grading the frozen surface; the projections, points, and ridges were cut away, and broken fragments of ice were used to fill up the hollows. Then upon condemned ties, about four feet apart, with some new timber interspersed, a track was laid with U rails, of about 40 lbs. to the yard, confined merely by hook-headed spikes, and without chairs.

The surface of the ice being some 10 or 15 feet below the permanent

rails upon the two banks, was gained by temporary inclines, running off from the shores upon a rough blocking of cob work, so arranged as to be adjustable, and taking advantage of a low pier on the left bank, to reduce the grade. These inclines, and the track across the ice, were connected with the main line on both banks, by suitable switches, and formed in fact a species of sideling nearly a mile long. Upon the inclines the baggage and freight cars were worked one way by *gravity*, and the other by *roping*, from the locomotive train. Forty freight cars per day, laden with valuable merchandise, have been worked over this novel track by the means above referred to, and were propelled across the ice portion by two horse sleds running upon the *sledge road*, and drawing the cars by a lateral towing line, of the size of a man's finger.

At the present writing, this novel and effectual means of maintaining the communication at Havre de Grace, is still in successful operation, and will so continue until the ice in the river is about to break up. Then by means of the sledges, the rails, (the only valuable part of the track,) can be rapidly moved off by horse power, not probably requiring more than a few hours time, so that the communication may be maintained successfully until the last moment. If properly timed, (as it doubtless will be,) the railroad may be removed, the ice may run out, and the ferry be resumed, it may be, in less than 48 hours.

We cannot conclude this brief notice by an eye witness, without expressing our admiration of the ingenious practical arrangement, adopted for overcoming an extraordinary difficulty at this point, by Isaac R. Trimble, Esq., the engineer of the railroad company.

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*The Submarine Telegraph.**

At about half past 10 o'clock on Thursday morning the last portion of the wire leading from the Foreland was brought close under the walls of the Castle at the summit of the cliff, and thence gently dropped into the garden attached to the temporary office of the Company. The wire was then led into one of the upper rooms and connected with the telegraphic instruments. In addition to the well known apparatus of Messrs. Cooke and Wheatstone, the more modern inventions of Messrs. Brett and Henley had been enlisted for the occasion. After some little delay, consequent on the rapidity with which the arrangements were made, the wires were finally connected, and it became a moment of intense anxiety when signals were about to be passed. The instrument of Messrs. Cooke and Wheatstone was set in motion, signals were interchanged with Calais, and the complete success of the undertaking was completely evinced. But very few communications had passed when a mounted messenger arrived with a despatch from the telegraph office of the South Eastern Railway Company. It proved to be a communication containing the prices of the funds on the London Exchange, which were to be immediately sent on by the submarine telegraph to Paris. The particulars of the message were of course kept secret, but it was gratifying to observe that it was duly forwarded. From this time despatches were continually passing between the Dover telegraph offices and London and Paris. A message from

*From Herapath's Railway and Com. Journal, No. 649, November 15, 1851.

London was sent to Paris and an answer received from Paris and forwarded to London within one hour, and this time, it must be remembered, includes the distance of a mile traversed twice between the Dover offices, bringing the London message to the office of the Submarine Company and transmitting the reply to the office of the South Eastern Railway. To this must be added the loss of time consequent on the message having to be sent from the Paris office to the Paris Bourse, and the time taken for the reply from the Bourse to the Paris office.

AMERICAN PATENTS.

List of American Patents which issued from January 13, *to February* 3, 1852, (*inclusive,*) *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

25. For an *Improvement in Machines for Scouring Knives and Forks;* Christopher Aumock, Columbia, Ohio, January 13.

Claim.—"I claim the construction of this machine, composed of two cylinder brushes, with their peripheries in contact, which causes the friction necessary for scouring or polishing, and at the same time keeps the cylinder brushes, which do the work of polishing or scouring, wet with the polishing substance continually, while the machine is in motion, by immersing the under side of said brushes in the liquid as they revolve around on their axis, as above mentioned. The article to be scoured or polished must be held in a perpendicular position, and moved up and down between the cylinder brushes while in the act of scouring or polishing."

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26. For a *Blind and Shutter Operator;* James R. Creighton, Cincinnati, Ohio, January 13.

Claim.—"Having thus fully, clearly, and exactly described the nature, construction, and operation of my improvement in window blind openers and fasteners, what I claim therein as new is, the sliding extension rod, provided with the bent arm or hook, groove, notch, and tooth, as described, in combination with the staple, catch, and serrated neck, fitting into a corresponding socket in the plate; whereby the shutter or blind is opened or closed by manipulation from the inside, and retained in position when opened, by the fallen bent arm in the staple, and when closed, by the introduction of the bent arm into the notch in the catch, the serrated neck, with its corresponding socket in the plate, preventing the bent arm from being dislodged from either position, by tampering from the outside."

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27. For an *Improvement in Running Gear of Carriages;* Gustavus L. Hausknecht New Haven, Connecticut, January 13.

Claim.—"I do not claim the separate use of one segment, on which the end of the perch rests; neither do I claim two pivots attached to the body: but what I do claim as my invention is, the placing the pivot in the rear of the forward axle, in combination with the two sets of segments or circles, viz: segments A, and segments D, seen at fig. 3, or their equivalents, substantially as above described."

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28. For an *Improvement in Apparatus for Cutting the Pile of Piled Fabrics;* John Johnson, Assignor to Elias Johnson, Troy, New York, January 13.

Claim.—"What I claim as my invention is, the method of connecting the cutter (one or more) with the carrier by means of a joint, substantially as specified, in combination with the guide or feeler (one or more), substantially as specified, whereby the guide or feeler is carried down, to determine the position of the cutter or cutters, before it or they begin to cut, as described.

"I also claim connecting the cutter or cutters and the feeler or feelers with the reciprocating carriage, by means of a spring joint, substantially as specified, so that the tension

of the spring, or its equivalent, shall draw the feeler or feelers against the range of loops to be cut, to insure the proper position of the cutter or cutters relatively to the range of loops to be cut, as specified.

"And finally, I claim the method of operating the cutters and guides or feelers towards and from the face of the cloth, and towards and from the lay, by connecting the ways on which the carriage runs, by arms, to the arms of a rock shaft, and to two inclined rocking joints, substantially as specified, whether the rock shaft be operated by the means specified or the equivalents thereof."

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29. For an *Improvement in Lanterns;* Philos Blake, New Haven, Connecticut, January 13.

"My improvement consists in attaching to the bottom of a lantern of any known or suitable construction, an additional appendage, whereby the lantern is made to rest securely and in an upright position on the top of the fore-arm of the person who carries it; thereby having both hands at liberty to perform manipulations, and at the same time presenting the light in the proper position for that purpose."

Claim.—"What I claim as my invention is, the combination of a lantern of any construction, with the additional appendage herein described and set forth, for the purpose of adapting the same to be carried on the top of the fore-arm, and of keeping it in an upright position. And this I claim, whether said appendage be constructed in the particular form and manner set forth, or in any other manner whereby the same object is accomplished, by substantially the same means."

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30. For an *Improvement in Ornamental Painting on Glass, &c.;* John W. Bowers, Brookline, Massachusetts, January 13.

"My process imparts to a painting on glass, an appearance very much like those figures which are executed on wood or papier mache, and which are more or less, or in part, made up of pieces of mother of pearl let into the wood. The paintings or figures produced by my said method have very beautiful properties of reflecting light, such as are often exhibited by silvered prismatic or crystaline surfaces."

Claim.—"What I claim as my improvement in ornamenting surfaces, consists in combining with the process of painting and ornamenting, by metallic foil, that of corrugating or crimping the foil, so as to impart to the figure or figures a power of reflecting light, so as to produce the sparkling, scintillated appearance, as specified."

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31. For an *Improvement in Machines for Dressing Stone;* Albert Eames, Springfield, Massachusetts, Assignor to Charles T. Shelton, City of New York, January 13.

"My invention relates to improvements on the machine for dressing stone, secured by letters patent granted to Charles Wilson, bearing date the 13th day of March, 1847, and re-issued 4th March, 1851."

Claim.—"What I claim as my invention is, making the upper surface of the ways elastic, substantially as described, in combination with the cutter carriage, constructed and operating in manner substantially as specified and for the purpose described.

"I also claim the manner, substantially as described, of mounting the stone carriage on wheeled axles, so that it can be elevated and depressed, in combination with the feeding platform, running on ways, substantially as described, so that the carriage can be run on wheels, to bring stones to and remove them from the machine, and be let down on to the platform, to receive the feed motion, as described.

"And, finally, I claim the dogs jointed to and in combination with the jointed arms, substantially as described, so that by means of wedges, or their equivalents, the block of stone can be adjusted and secured in place, as described."

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32. For an *Improvement in the Shakers of Winnowing Machines;* Henry Filburn, Dayton, Ohio, January 13.

Claim.—"What I claim as my invention is, the method of moving the shaker fingers, in the manner and for the purposes herein set forth."

33. For an *Improved Ornamental Connexion of the parts of an Iron Fence;* Henry Jenkins, Cincinnati, Ohio, January 13.

Claim.—"Having thus fully described my improvements in manufacturing fences, what I claim therein as new is, connecting the parts of a wrought iron fence to each other, by casting iron ornaments upon them, for the purposes of ornamenting and fastening the parts together, substantially in the manner herein described."

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34. For *Improvements in Beveling Planes;* Harrison W. Lewis, Bath, New York, January 13.

"This invention consists of a plane, or planing instrument, of peculiar form and furnished with several peculiar devices, so as to be adapted to the purpose of forming at one operation, and with extraordinary accuracy, a double bevel upon the grooved edge of a stile or rail of a panel door."

Claim.—"What I claim as my invention are, 1st, the adjustable gauge bar and the vertical adjustable guide, in combination with the double faced plane stock, all constructed and relatively arranged as herein described.

"2d, The combination of the guard screws, guard stock, adjustable guard, gauge bar, vertical guide, and plane stock; the whole being constructed and arranged, substantially in the manner and for the purpose herein set forth."

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35. For an *Improvement in Looms for Weaving Piled Fabrics;* Charles A. Maxfield, Troy, New York, January 13.

Claim.—"Having thus described my invention and improvement in the loom for weaving pile fabrics, I wish it to be understood, that it is not my intention to claim the use of the figuring or pile wires, upon which the loops or pile is raised; but what I do claim to have invented is, 1st, the employment on each side of the loom, of a wing, constructed substantially as described, when mounted upon either end of the lay, rock shaft, moving independent thereof, and of each other, and vibrating alternately with each other, in the arc of a circle scribed from the said rock shaft, and upon each are mounted the ways of the pile or figuring wires, whereby the said wires are carried rearward, to be re-inserted into the open shed, and thence forward to the last pick of the woof, or weft, as described.

"2d, I also claim causing the wings to recede, to carry the wires to the open shed, and then advance frontward with the wires to the woven pile, alternately, by the action of the lay itself, each wing being locked to the lay at the proper moment, and disengaged therefrom on the insertion of the wire, by the action of the curved lever as described.

"3d, I likewise claim pivoting the ways of each wing, and furnishing the inner ends thereof with arms projecting into openings in the breast beam, whereby the ways, with the figuring wires, are made to maintain a horizontal position, during the vibration of the wings, in the arc of a circle, as described.

"4th, I also claim providing each wing with a holding lever, pivoted to the frame and vibrating with the motion of the wing, and locked by means of a spring plate and pivoted arm, actuated by the advance motion of the double arms of the rock shaft, when the wire is at rest in the warp, whereby the wing is retained steadily in its position, until the withdrawal of the figuring wire.

"5th, I also claim combining the intermediate sliding arm, horizontal rods, with the carrier and wire, whereby the middle of the latter is sustained and prevented from trembling, whilst being inserted and withdrawn from the web, as described."

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36. For an *Improvement in Machines for Making Sugar Candy;* Bartholomew O'Brien, Rochester, New York, January 13.

Claim.—"What I claim as my invention is, making candy by machinery substantially as set forth."

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37. For an *Improvement in the Apparatus for Attaching pieces of Metal to each other, by Casting;* Horatio B. Osgood, Thompsonville, Connecticut, January 13.

"My improvement consists in making the jaws movable, so that they may be adjusted

to their proper positions, or changed for different shaped steel, when required, and so as to allow the levers to shrink, without any risk of straining the castings."

Claim.—"What I claim as my invention is, the use of movable jaws attached to the permanent parts of the flask, for the purpose of holding the steel pivots, or bearings, of levers and beams of platform scales and other analogous articles, firmly in the exact position required for use, while the fused iron or other metal is being poured into the mould, so as to fix them securely in the lever, &c., and so that the movable jaws will readily yield to the shrinkage of the metal while cooling, and prevent any injury from straining any of the parts, when the whole is constructed, arranged, and fitted to operate, substantially as herein described."

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38. For an *Improvement in Buckwheat Fans;* Alfred Platt, Waterbury, Connecticut, January 13.

Claim.—"What I claim as my invention is, the method of separating the hulls from the kernels of buckwheat, by shaking them on a table, or tables, made slightly concave and rough, substantially as specified, in combination with a current or currents of air blown over the surface of such table or tables, to carry off the hulls, whilst the kernels are retained or held back by the form of the surface of the table or tables, as specified."

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39. For an *Improvement in Machinery for Punching Sheets of Metal;* Samuel Lanford, Fall River, Massachusetts, January 13.

Claim.—"What I claim as my improvement is, the combinatiou of the hinged flaps, M M, and their levers N N, restoring springs and tripping studs, or equivalent mechanic contrivances, with the movable carriage and the punching cylinders or mechanism; the whole being arranged and made to operate substantially as herein before specified."

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40 For *Improvements in Apparatus for Moulding in Flasks;* Edward Satterlee, Albany, New York, January 13.

Claim.—"Having thus fully described the parts and combination of parts, and operation of the moulding machine, what is claimed therein as my invention is, the making of moulds, in and by the alternate motions of a sifter, sliding knife to cut off the sand when the flask is filled, press, and movable bed, connected with and worked by the continuous motion of a single shaft, substantially as described in this specification."

"I do not cliam the sifter or press as my invention.

"I also claim as my invention, the moving, stopping, and starting of the bed, to and from the points, where the operation of sifting, filling, and pressing the sand are doné, by the continuous rotary motion of a single shaft, substantially as described in the specification.

"I also claim the method of striking the surplus sand from the top of the flask after the curb is removed, by means of a self adjusting bar or knife, substantially as described and set forth in this specification."

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41. For an *Improvement in Metallic Heddles;* Jacob Senneff, Philadelphia, Pennsylvania, January 13.

Claim.—"What I claim as my invention is, casting the eye on the wire which constitutes the heddle, harness, or heald, through which the warp passes, in the manner and for the purpose set forth, producing a heddle much superior to any other known or used, and which will remove many of the difficulties heretofore experienced, in the use of the common twisted wire heddle."

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42. For an *Improvement in Turning Prisms, &c.;* Allen Sherwood and Avery Babbett, Auburn, New York, January 13.

Claim.—"What we claim as our invention is, the prismatic lathe herein described, consisting, essentially, of a rotating cutting instrument, whose cutters, in rotating, combine to describe a figure whose longitudinal sections are the counterparts of the outline of the longitudinal sections of the figure to be produced, and of a carriage to hold the block in

such a position, that its axis is always parallel with that of the cutting instrument, and at the same time, to move it transversely to the same, for the purpose described, and allow it to be turned on its axis at pleasure, and to be held from turning, while being acted upon by the cutters."

43. For *Improvements in Machines for Splitting Rattan;* Joseph Sawyer, Royalston, Massachusetts, January 20.

Claim.—"Having thus fully described my invention, what I claim as new is, the employment, in combination with the cutters for splitting off the strands, of feed rollers or their equivalents, having grooves of the form of an angle or certain of the sides of a polygon, of which the edge or edges of the knife or knives form another side or other sides, substantially as and for the purposes herein described."

44. For an *Improved Process of Mashing Maize;* Frederick Seitz, Easton, Pennsylvania, January 20.

Claim.—"Now what I claim as my invention and improvement in the brewing and distilling business is, the above specified preparation and boiling of the corn for brewing and distilling, boiling it to a jelly before the malt or rye is mashed into it, giving a much larger than the usual yield from cheaper material, enabling me to use one-half to two-thirds corn for beer, ale, and porter, and to make 19 quarts of whiskey from 60 pounds of corn, (including the usual quantity of malt only, and no rye,) and 21 quarts, with rye, as specified."

45. For *Improvements in Planing Machines;* G. W. Tolhurst, Cleveland, Ohio, January 20.

Claim.—"Having thus fully described my invention, I would state, I am aware that the stocks and cutters of planing machines have been made to yield upon an axle, the centre of which is in line with the cutting edge of the knife. This I do not claim; but what I do claim is, hanging the stock at a line above the edge of the cutter, to a spring or weighted lever, in the manner described, in combination with the resting of the front part of the stock upon a fixed surface, so that when the back part of the stock is made to rise, the whole stock is thrown forward and upward, thus keeping the edge of the cutter at the same level, notwithstanding the change in its angle with the bed."

46. For an *Improvement in Grain Harvesters;* Thomas Van Fossen, Lancaster, Ohio, January 20.

Claim.—"Having thus fully described my invention, what I claim therein as new is, constructing the reel with hinged or jointed slats, having teeth projecting from them, whereby the grain is more effectually collected, raised, and drawn into the action of the cutters, substantially as described.

"I also claim the combination of the teeth with the sliding platform, which teeth rise and fall at the desired time, alternately, arresting and releasing the cut grain, whereby the reciprocating motion of the platform will keep the cut grain strait, and constantly moving on the platform towards the trough, substantially as described."

47. For an *Improvement in Canal Locks;* W. W. Virden, Havre de Grace, Maryland, January 20.

"The nature of my invention refers to the economizing of water, in passing canal or other boats from one level to another, and consists in the use of plungers or floats working in suitable chambers, provided with appropriate passages and wickets connecting them with the lower level, to which plungers the boat in its passage through the lock is attached, so that in falling to the lower level, the weight of the boat is made to force up the water in the float chambers to the higher level, thus contributing to the latter level an amount of water to sustain the loss by the quantity passing off the lower level."

Claim.—"What I claim as my invention is, causing the weight of the descending boat to act as a supplying power to the higher level, by the use of plungers or floats, (any number,) fitting in suitable chambers, provided with appropriate passages, and communicating

with the higher and lower levels for operation, in the manner essentially shown and described."

48. For an *Improvement in Spring Mattresses;* John Waters, Southwark, Pennsylvania, January 20.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, the method herein described of securing the springs of spring mattresses to the frame and to each other, so as to leave the tops of the springs free to play or yield to any pressure, viz: by connecting them together by a riveted leather hinge, and allowing the longitudinal and cross pieces of the frame to pass through a slot in said leather hinges, the whole being combined and arranged in the manner and for the purpose set forth."

49. For an *Improvement in Mills for Grinding Quartz;* Horatio Blasdell, City of New York, January 20.

"The distinguishing feature of improvement consists in so constructing and combining the several parts of the mill, that the quartz rock shall be received and cracked or reduced so as to pass between the grooved surfaces of the semi-spherical runner and concave, wherein the quartz is held, and the particles thereof made to act by friction directly upon each other, and thus effect its own pulverization, and allowed to descend gradually to circular channeled rings, between whose surfaces the quartz is reduced to the fineness of flour."

Claim.—"Having thus described my mill for reducing gold quartz rocks to a powder or flour, what I claim as new is, the combination of the chilled hollow cylinder R^2, and nut S, of the form represented, and the grooved chilled rings W E^2, and horizontal circular channeled chilled ring plates R X, with the grooved concave E, and runner T, for breaking, pulverizing, and powdering gold quartz rock; the said chilled rings and plates being arranged and operating in the manner and for the purpose herein fully set forth."

50. For an *Improvement in Churns;* Edwin B. Clement, Barnet, Vermont, January 20.

Claim.—"What I claim as my invention is, the application to dashers for churns, of floats that shall close together at their appointed place, when pressed downwards through the cream or milk, forcing the cream or milk through narrow spaces, and opening again when raised from the bottom; claiming the right of composing the dasher of any materials, and in any combination of the above described parts, so as substantially to produce the same effects."

51. For an *Improvement in Machines for Drilling Stone;* Henry Goulding, Boston, Massachusetts, January 20.

"My improved machine is intended to be used either as a power or hand drilling machine, and is so constructed as to drill in any direction, the drill being set in a swinging frame, and operated by the friction of two sets of grooved wheels, with movable journals, so placed with regard to each other as to turn the drill as it is driven."

Claim.—"Having thus described my improved drilling machine, what I claim as my invention is, 1st, driving the drill forward and back by adjustable wheels, between the edges of which the drill shaft is placed, substantially as above described.

"2d, I claim turning the drill, by placing said wheels at an angle to each other, substantially as herein above described.

"3d, I claim feeding the drill forward, as the hole is deepened, by making the bearing surface of the wheels which drive the drill in, of greater strength than that of the other wheels."

52. For an *Improvement in Washing Machines;* John McLaughlin, Goshen, Ohio, January 20.

Claim.—"Having thus fully described the nature, construction, and operation of my improved washing machine, what I claim therein as new is, the method of hanging and operating the plunger, by means of the shackles and the heavy counterpoise handle, as described."

53. For an *Improvement in Hand Printing Presses;* Henry Moeser, Pittsburg, Pennsylvania, January 20.

"The object of the represented arrangement is to avoid the sliding motion of the platen, as it is most generally the case with hand presses; for that purpose, the tympan plate is constructed movable around the hinges, and the impression effected from below, by pressing the platen with the types against the tympan, as will be shown."

Claim.—"What I claim as my invention is, the tympan plate of a printing hand press, removable by hinges, and counterbalanced, together with the manner of holding the tympan plate in its position. (when lowered down,) for the purpose of resisting effectually the pressure exercised from below, substantially as described."

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54. For an *Improvement in Spinning Machinery;* Oliver Pearl and Henry P. Chandler, Lawrence, Massachusetts, January 20.

Claim.—"But what we do claim as our improvement is, the arrangement of the whirl at the base of the flyer, in combination with making the said whirl and the bearing on which the whirl is placed and rotates, with a passage through them large enough to allow the bobbin to play within the same, and up and down between the flyer legs, substantially in manner and for the purpose as specified."

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55. For an *Improvement in Self-Sharpening Grindstones;* Jesse Pennabecker, Elizabeth Township, Pennsylvania, January 20.

Claim.—"What I claim as my invention is, the combination of a grindstone with a self-acting picker, by which the grindstone is sharpened by its motion or power, as herein described, or in any other manner substantially the same."

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56. For *Improvements in Nail Machines;* Samuel G. Reynolds, Worcester, Massachusetts, January 20.

"The object of my invention is to avoid the difficulties heretofore encountered in the manufacture of wrought iron nails, and consists in the employment of cutters to sever tapered pieces, by cutting from a plate, rolled to the required thickness of the thickest part of the shank of the nails, and making the taper alternately from opposite sides, and so proportioned that the cross section, taken at any part of the shank, shall have the same or nearly the same amount of metal after the cut, and when the nails are completed, when this is combined with griping or moulding dies, which receive the cut pieces from the cutters by some suitable conveying means, and which mould them by causing the metal to spread, instead of elongating, and retain the same or nearly the same amount of metal in any and all parts of its length."

Claim.—"Having thus described my improved method or process of making wrought nails, and the machinery for the same as I have essayed it, I wish it to be distinctly understood, that it is susceptible of modifications, as for instance, instead of making an active pressure on all four faces of the blank, to give the required form, the same thing may be accomplished, although not so well, by making active pressure on two faces, and simply presenting resistance to the other two faces.

"What I claim as my invention in the making of wrought nails is, the employment of the cutter for cutting wedge-formed pieces from a previously rolled plate, of equal or nearly equal thickness, substantially as described, preparatory to and in combination with the moulding dies which receive the cut pieces, by suitable conveying apparatus, from the cutters, and mould them to the required form by pressure, substantially as specified, so as to give the form by spreading the metal between the dies, instead of by elongation, as heretofore practised when making nails from cut blanks.

"I also claim the vibrating cutter, and the faces or dies for confining and compressing the nails arranged on both sides of the said cutter, substantially as described, when this is combined with the two stationary cutters, having a space between the two, through which the rod or plate of iron is fed, substantially as described."

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57. For an *Improvement in Brick Kilns;* William Linton, Baltimore, Maryland, January 20.

"My improvements consist in the form of the bottom of the fire arches, and in the mode

of introducing the air into the furnace, for igniting and burning the fuel, and causing a free, steady, and unimpeded heat, equalized throughout the body of the kiln, by which I am enabled to greatly economize the fuel, and burn a kiln of bricks, or other articles manufactured of clay, more evenly and expeditiously than by any other mode with which I am acquainted."

Claim.—"Having thus fully described my improvements, what I claim therein as new is, forming air arches or openings in the kiln, between the fire beds, with lateral openings therein, through which a sufficient amount of air can be supplied equally to all parts of the fire bed at the same time, substantially as herein described."

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58. For an *Improved Cast and Wrought Iron Blind;* Robert White, Washington, District of Columbia, January 20.

Claim.—"I do not claim the combining cast and wrought iron, nor do I claim to be the first to have cast metal round cold metal, and joining the same by that means; but what I do claim as new is, producing a new product or article of manufacture for shutters, doors, &c., whereby I am enabled to use wrought iron slats, and prevent the contraction of the metal, in cooling, from warping the same, by casting the top, centre, and bottom plates separately and distinct from the side plates, and running the side plates to the slats and plates, substantially as herein set forth."

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59. For an *Improvement in Piano Forte Action;* Geo. Brown, Assignor to Geo. Brown and John Munro, Boston, Massachusetts, January 27.

Claim.—"I therefore claim in the upright piccolo piano forte action, the arrangement of the back catch lever L, in front of the back catch, and so that the rear side of the bearer shall operate in connexion with the front side of the back catch."

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60. For an *Improvement in Sand Paper Holder;* Azel H. Copeland, West Bridgewater, Massachusetts, January 27.

Claim.—"Having thus described my invention, I shall state my claim as follows: what I claim as my invention is, the implement called a sand paper holder, constructed substantially as above described; that is, of two similar pieces of wood, with handles at the ends, the inner sides flat, and the other sides rounded, joined together lengthwise by a hinge of cloth or leather, so that the flat sides can be brought together; the outer edges of the flat sides having small wire pins inserted in them, by which the sand paper is held, and the two pieces being held together, when closed by dowels in one of the flat sides entering corresponding holes in the other flat side."

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61. For an *Improvement in Mill Spindles;* Egbert T. Butler, Buffalo, New York, January 27.

"My invention relates to spindles for mills, in which the runner stone is held to its work by pressure, and consists in making and uniting the parts of the spindle where they connect to the driver, and connecting them to the driver in such a manner as to secure solidity, compactness, durability, and ease of operation, by the means hereinafter described."

Claim.—"Having thus fully described my invention, I claim, 1st, Uniting the upper and lower parts of the spindle, by means of the driving chuck or key, made substantially in the manner and for the purposes herein set forth.

"2d, I do not claim the vibrating centre separately, but I do claim it in combination with the driving chuck or key, and the method herein described, of uniting the parts of the spindle."

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62. For *Improvements in the Ring Spinner;* Geo. H. Dodge, Attleborough, Massachusetts, January 27.

Claim.—"What I claim as my invention is, the combination of the standard or projection B, with the ring and traveler, substantially in manner and for the purpose of removing or loosening waste from the latter, as specified."

63. For *Mechanism for Operating the Relief-Valve in Partially Condensing Engines;* William Few, St. Louis, Missouri, and Francis Armstrong, New Orleans, Louisiana, January 27.

Claim.—"Having thus described the construction and operation of our invention, what we claim therein as new is, the arrangement and combination of the partial escape or relief-valve W^2, plate Z, reciprocating lifting box Y, connecting rod *j*, crank lever X, and rock shaft T, whereby the said relief-valve W^2, is actuated simultaneously with the opening of either of the exhaust valves, and allowed to close again, as herein set forth."

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64. For an *Improvement in Cooking Ranges;* John P. Hayes, Boston, Massachusetts, January 27.

Claim.—"Having thus described my improvements in cooking ranges, I shall state my claim as follows: What I claim as my invention is, the combination of the pipes, arranged with fire spaces between them, with the hot air flues and driving flues of the brick work on the back and side of the oven, by which hot air is circulated through the oven, and back again to the chamber about the fire pot, and so on continuously, this hot air being used either for baking or for heating the apartments of the house.

"2d, I claim the use of swing doors, arranged one on each side of the front of the fire pot, serving for radiating surfaces, in connexion with the said front of the fire pot, for roasting purposes, and to admit the cold air when opened, as herein above described and set forth."

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65. For an *Improvement in Water Metres;* Samuel Huse, Boston, Massachusetts, January 27.

Claim.—"What I claim as my invention is, combining with a cylindrical case, such as herein described, and provided with induction and eduction passages, and with a segmental stop and leather cap plate, for packing, substantially as described, a series of hinged segmental pistons, hinged to arms projecting from a central shaft or hub, and hinged at about one-third of the distance from their inner ends, so that when thrown open, their outer ends shall not bind against the inner periphery of the cylinder, and when closed to pass the segmental stop, they shall be sustained by a rest projecting from the central shaft or its equivalent, having a space between them and the shaft and arms for the free flow of water, or other fluid, under the said pistons, to admit of their closing freely; the whole being made and combined substantially in the manner and for the purpose specified."

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66. For an *Improved Nail Plate Feeder;* Caleb Isbister, Allegheny City, Pennsylvania, January 27.

Claim.—"What I claim as my invention is, 1st, The giving to the nail plate, an interrupted rotary motion in the same direction, instead of the reciprocating, partially rotating motion in opposite directions, usually given to said plate, and this I claim irrespective of the mechanical devices by which said motion is communicated.

"2d, I claim the combination of the sectional cog-wheel always moving in the same direction with the cylindrical cog-wheel, having irregular teeth, working between guides, having a mouth piece, and with the springs and spring plate, or their equivalents, by means of which, both an interrupted rotary and a rising and a falling motion is communicated to the nail plate.

"3d, I claim giving a continuous forward and an interrupted forward and backward motion to the nail plate, by means of the revolving shaft, screwed tube, cam and guide pin, and nut, *w*, combined with each other substantially as herein described."

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67. For *Improvements in Iron Railings;* Benjamin Kraft, Reading, Pennsylvania, January 27.

Claim.—"What I claim as my invention is, the method of constructing a self-adjusting and fastening fence, by forming the posts in two pieces, substantially such as herein described, making two sides of one part of the post, with mortises at the top and near the bottom, for the reception of the rails, and the other piece, when in place, retaining them in position.

"I claim the tongues, I I, connecting the hollow cap J, provided with a tongue K, and groove K, with the uprights, or panels, *o o*, said tongues passing between the rails, and with the cap J, serving as a hook to sustain the uprights or panels."

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68. For an *Improvement in Railroad Switches;* Abm. S. Miller, Republic, Ohio, January 27.

Claim.—"Having described the nature of my invention, what I claim is, placing the tumbler, figures 4 and 5, under the rails L and K, in such a manner as to ease their movement, and when at rest, operating as a brace, or key, to retain the rails in place."

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69. For *Improvements in Fire-Arms;* Charles V. Nickerson, Baltimore, Maryland, January 27.

Claim.—"Having thus described my improvement in fire-arms for loading at the breech, where the barrel is banded or secured to the stock, I wish it to be understood that I make no claim to being the original inventor of a fire-arm, or gun, loaded at the breech, such as that patented in France, to Mr. Tourrette, of Paris, on the 24th November, 1834, described in "*Brevets d'Inventions, Vol.* 55," and in descriptions of other guns which are loaded at the breech, patented and unpatented; but what I do claim as new is, dividing the stock at the junction of the barrel and breech, and mounting the barrel and that portion of the stock to which it is attached, with a sheath or case, upon a longitudinal bar or tongue, projecting from the but of the stock, as represented in the drawings, whereby the stock and barrel are allowed to have a movement from the breech, for inserting the cartridge into the chamber thereof, and returned and locked by a catch to confine them together."

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70. For an *Improvement in Shingle Machines;* Luther B. Parker, Pine Township, Pennsylvania, January 27.

"The nature of my invention consists in an improvement in Woods's patent self-feeding shingle machine, for cutting and jointing shingles; this improvement consists in this—I do not use the machinery for self-feeding, but in my improvement you feed by hand."

Claim.—"What I claim as my invention is, the application of the vibrating and gauging the shingles. The shingle blocks are laid on the bench, and are pressed against the vibrating rod, one end resting against the centre panel of the knife sash; then as the sash moves up and down, the shingles are cut off the block and finished at one stroke of the machine, while the block can be turned at leisure, to suit the grain of the wood."

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71. For *Improvements in Ships' Davits;* Charles Perley, City of New York, January 27.

Claim.—"I do not claim any of the separate parts themselves, but I do claim as new and of my own invention, the application of the socket *d*, on its hinge 5, in combination with the socket *c*, and davit *e*, for the purposes and as described and shown."

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72. For an *Improvement in Neck Yokes;* John T. Plato, Jasper, New York, January 27.

Claim.—"Having thus described my invention, what I claim therein as new is, the combination of the washers C, the swivel B or E, bolt *a*, and nut D, with the ordinary neck yoke, arranged in the manner and for the purpose herein set forth."

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73. For an *Improvement in Railroad Switches;* Ira Reynolds, Republic, Ohio, January 27.

"The nature of my invention consists in attaching radial links, or arms and swiveled levers, to the stay bar connecting the switch rails, in such a manner as to secure a perfect change, and lock for the same."

Claim.—"I do not wish or intend to claim the placing or attaching of links, arms, or tumblers, under the switch rails, or stay bars, for the purpose of carrying them over; but what I do claim is, 1st, the attaching of the links or arms to the stay bar, or switch rails, and superstructure, for the purpose of holding the switch rails against the undue action of the levers, and securing them in a perfect and uniform motion, when acted upon by the

levers, also to act as a stay or lock, which shall effectually hold and secure the switch rails, in every position, substantially as set forth.

"2d, I claim a combination of the pivoted levers, furnished with peculiar formed ways, with the operative shoe, so constructed and arranged, that the switch rails are moved upward and laterally, in manner substantially as described."

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74. For an *Improvement in Windlasses;* Amzi C. Semple, Cincinnati, Ohio, January 27.

Claim.—"What I claim as my invention in the above described press is, winding the rope upon a screw with a concave score between the threads, that fits the rope and supports it in its proper form, thereby lessening the wear of the rope and its liability to be broken, in the operation of pressing, when the said screw is made to work through a fixed nut, so as to always draw the rope in the same position, substantially as described."

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75. For an *Improvement in Shears;* John C. Symmes, West Troy, New York. January 27.

"This invention relates to an improvement in the pivot, by which the edges are drawn together sideways, in cutting, and all inconvenience arising from the looseness of the pivot, in ordinary scissors and shears, is effectually remedied."

Claim.—"What I claim as my invention is, making the pivot and the hole in one or both limbs in which it fits, of such form as exemplified at O, as to cause the edges of the blades to be drawn together sideways, by the power applied in cutting, as herein fully set forth."

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76. For an *Improvement in File Cutting Machines;* James H. Thompson, Paterson, New Jersey, January 27.

Claim.—"What I claim as my invention is, 1st, the traveling and revolving elongated elliptical cam, in combination with the connecting rod or its equivalent, communicating a varying amount of motion to the rock shaft, which motion is conveyed, through suitable mechanism, substantially such as is described, to the screw, by means of which a varying rate of travel is communicated to the chisel.

"2d, The inclined plane, or its equivalent, in combination with a jointed chisel stock, or its equivalent, pressed against said plane by the spring, or its equivalent, substantially as described.

"3d, The springs, or their equivalents, to press the axis of the stock into the scores in the sliding bar.

"4th, The springs, or slide and spring, whether used separately or combined, to press the cross against the pillars, so that the file may remain upon the bed, in that position in which it is placed, by one stroke of the chisel, until it is struck again, thereby dispensing with the roller heretofore used to press the file against the bed."

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77. For *Improvements in Machines for Making and Sizing Paper;* Geo. W. Turner, London, Great Britain, January 27.

Claim.—"What I claim as my invention is, 1st, the application of the endless wire web, in combination with and passing round the cylinder, and taking the pulp up from the vat, and carrying it forward, and submitting it to the action of the dandy roller and pneumatic trough, taking the place of the fixed wire web and endless felt in the cylinder machines now in use, and the wire web upon which the pulp flows in the above mentioned Fourdrinier's machine. I am aware that a somewhat similar combination is found in Millbourn's machine, reported in *Repertory of Patent Inventions*, 5th Series, Vol. 9, p. 325, dispensing with the cylinder D; but that I do not claim.

"2d, I claim the method of passing the paper through a trough of size, between two endless felts, or other fabrics, as above described, thereby obtaining a perfect and uniform saturation of the paper, and protecting the paper from all injury, during the process of sizing and pressing."

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78. For an *Improvement in Burglar Alarms;* L. J. Worden and E. H. Space, Clinton, New York, January 27.

Claim.—"We do not claim the clock movement, as that is a well known and old inven-

vention; neither do we claim the lever K, for the purpose of operating upon the pallet F; but what we do claim as new is, the securing of the lever K, after it has been moved by the button M, so as to allow the pallets F, F, to be acted upon by the 'scape wheel D; said lever K being secured by the end *m*, of the lever, N, fitting in a groove or recess, *o*, in the end *j* of the lever K, the end *m* being forced into the groove or recess *o*, by the spring *n*, substantially as shown and described."

Re-issue for January, 1852.

1. For an *Improvement in Planing Machines;* Charles A. Spring and Peter Boon, Kensington, Pennsylvania; patented July 30, 1850; re-issued January 13, 1852.

Claim.—"Having thus fully described our improved machine, we wish it to be understood, we do not claim a bench that can be raised and lowered by set screws, or similar device; but what we do claim as our invention is, 1st, hinging the bed-piece at one end, and raising and lowering it at the other, in combination with the revolving cylindrical cutter, in the manner and for the purpose set forth.

"We also claim the combination and moving of the feed rollers (g') with the stationary ones, by the oblique links and gear, as described, the whole being constructed and operating as before specified."

Designs for January, 1852.

1. For a *Design for Stoves;* James G. Abbott and Archelus Lawrence, Philadelphia, Pennsylvania, January 6; ante dated December 11, 1851.

Claim.—"What we claim as new and of our invention is, the design or ornament, shape and configuration of stove plates, as represented in the annexed drawings at D E F, figs. 1, 2, 3."

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2. For a *Design for Stoves;* James G. Abbott and Archelus Lawrence, Philadelphia, Pennsylvania, January 6; ante dated December 11, 1851..

Claim.—"Having thus described and represented our new design of stove plates for "the Complete Cook," what we claim as new is, the design and configuration of ornamental stove plates, substantially as described and represented at A B C D E F G H I J, of the accompanying drawings."

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3. For a *Design for Stoves;* Sanford Burnam, Waterford, New York, January 6.

Claim.—"Having thus described the design of my stove, what I claim is, the design and configuration of ornaments, arranged and combined substantially the same as represented."

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4. For a *Design for Spoons;* Henry Hebbard and John Polhamus, City of New York, January 6.

Claim.—"Having now described our invention of a new and ornamental design for spoons or other articles, what we claim as our invention is, the use of the ornamental design, substantially as herein set forth, for the purpose of ornamenting spoons, forks, or other articles to which it may be applied."

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5. For a *Design for Stoves;* William Savery, City of New York, January 6.

Claim.—"What I claim as new and original is, the design and configuration of the several ornamental figures on the front and bottom plates of a certain stove, as represented in the annexed drawings and as above described."

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6. For a *Design for Stoves;* J. Harvey Conklin, Peckskill, New York, January 6.

Claim.—"What I claim as my invention is, the configuration and design of the several ornaments and their mouldings, particularized on the front, sides, doors, legs, and feet of the stove, formed and arranged as depicted and described."

7. For a *Design for Stoves;* James Wager, David Pratt, and Volney Richmond, Troy, New York, January 13.

Claim.—"Having thus fully described our design, what we claim therein as new is, the foregoing described configuration of the plates, forming an ornamental design for a stove, as represented and illustrated by the drawings."

8. For a *Design for Floor Oil Cloth;* James Paterson, Assignor to James Allen, Elizabethtown, New Jersey, January 13.

Claim.—"What I claim as my invention is, the representation of trunks of trees and andscape, as in the accompanying drawings, for a design for floor oil cloth."

9. For a *Design for Coal Stoves;* John Burgess, Assignor to Geer, Chaffee & Richmond, Troy, New York, January 13.

Claim.—"Having thus described and represented my new design, what I claim is, the design and configuration of a cast stove, substantially the same as described and represented in the annexed drawing."

FEBRUARY, 1852.

1. For an *Improvement in Hemp Brakes;* Lewis S. Chichester, Williamsburgh, New York, February 3.

Claim.—"What I claim as my invention is, making two or more breaking and cleaning cylinders, with fixed rods at or near their peripheries, and radial plates made to slide radially, (or some of them fixed,) operated substantially as herein described, in the spaces between the rods, substantially as described; the two or more cylinders being geared together so as to turn with equal velocities, and so placed, that in their rotation, the rods and plates of one cylinder shall come opposite to those of the other cylinder, for the purpose and in the manner substantially as set forth.

"And I also claim the combination of springs substantially as described, with the sliding plates of the cylinder or cylinders, operated substantially as herein described, for the purpose of rendering the plates self-adapting to the material introduced, and insure its being properly griped, and held so as to admit of slipping, without undue strain on the fibres, as described."

2. For an *Improvement in Grass Burners;* John A. Craig, Columbia, Arkansas, February 3.

Claim.—"What I claim as my invention is, the application to the surface of the ground, flame for agricultural purposes, using for that purpose, the above described machine, or any other substantially the same, which will, by heat, produce the intended effect."

3. For an *Improvement in Feeders for Planing Machines;* Jno. Cumberland, Mobile, Alabama, February 3.

"This machine as constructed, is composed of two general parts: The first consists of a stationary plane or bed-piece; and the second of a movable platform, which is subject, for the purposes of description, to further division, as will appear hereafter."

Claim.—"What I claim is, my above described combination of a bed-piece with the spring, lever, connecting rod, arm, tumbler and clicks, and its grooves, guides, and rack, with a movable platform, with the adjusting levers and ratchets, for the production of a lateral traverse and lost motion, with its adjustable table, adjusted by springs, weights, screws, or other known means, with its hand wheels, rollers, vertical ratchets, and balance clicks, and of a frame with its pully and half wheel, for the purpose of delivering or receiving material thereon; the whole being constructed, combined and operating as above set forth and described, and for the purposes mentioned."

4. For an *Improvement in Street Sewers;* Willard Day, Brooklyn, New York, February 3.

Claim.—"Having thus described the nature of my invention, and the manner in which it operates, what I claim as new is, the combination of the basin placed at the bottom of the inclined drain, and at the side of the sewer, with a single man hole, so placed as to give access to the basin and sewer."

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5. For an *Improved Door Spring;* Henry Hochstrasser and Abrm. Masson, Philadelphia, Pennsylvania, February 3.

Claim.—"We do not claim the straight piece of steel for a spring, as new, neither do we claim having the spring act most powerful when the door is closed as new; what we do claim as new and our invention or improvement is, the application and mechanical arrangement of a curve, in connexion and combination with a spring and rollers, for the purpose of a door spring, whose power will be exerted more strongly when the door is closed, or about closed, than when open entirely or partially, as herein described."

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6. For an *Improvement in Gas Purifying Apparatus;* Abram Longbottom, City of New York, February 3.

"My invention relates to certain improvements in the method of purifying illuminating gas, whereby the washing apparatus is wholly done away with, so that the gas comes from the retorts or furnaces, completely purified and ready for consumption,"

Claim.—"What I claim as my invention is, purifying the gas, by passing it through a mixture of equal measures of quick lime and of animal charcoal, in the same retort in which the gas is generated, but at a temperature, so regulated, that at the lowest point, or where the gas enters the composition, the mass is at a lowered heat; and at the top, or where it leaves the composition, the heat is below redness, substantially in the manner herein set forth."

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7. For an *Improved Method of Keeping the Valves of Oscillating Engines upon their Seats;* Ephraim Morris, City of New York, February 3.

Claim.—"I claim the pressure plugs, or their equivalents, acting against the caps, or their equivalents, in combination with the steam chest, valve, and valve seat or seats, vibrating with the steam cylinder; said plugs operating to keep the valve or valves on to the seat or seats of the same, as described and shown."

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18. For an *Improvement in Axletree Arms;* David Philips, Sharon, Pennsylvania, February 3.

"The object of my invention is to obtain the advantages of wooden and iron axletrees in the same wagon, and it consists in a compound arm and cap, which is formed of metal, and is applied to the extremity of a wooden axletree, so that the wagon wheels rotate upon iron arms of small size, and, consequently, with a small amount of friction, while the elasticity of a wooden axletree, and the advantages incident thereto, are retained."

Claim.—What I claim as my invention is, constructing metallic arms for axletrees, with sockets and ribs, as herein set forth, so that the arm can be attached to the wooden stock, or body of the axletree, without the employment of the hoops, clips, and screw bolts heretofore employed, even when the stock is as small, or of less diameter than the arm."

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9. For an *Improvement in Concentrated Beer Material;* Franz G. Rietsch, Rudoletz, Austria, February 3.

Claim.—"What I claim as my invention is, the new and useful preparation of matter herein described, termed, Zeilithoid."

10. For *Improvements in Ships' Blocks;* William and Stephen G. Coleman, Providence, Rhode Island, February 3.

Claim.—"What we claim as our invention is, the method of making ships' blocks, by placing the metal straps edgewise, that is, with its greatest breadth in the direction of the plane of the axis of the sheaves, and extending from the sides of the sheave to the outside of the cheeks, substantially as specified, when this is combined with the attachment of the cheeks in segments to the wide faces of the straps, substantially as specified.

"And we also claim making the cheeks of ships' blocks in segments of a ring, substantially as specified, whereby the elongated form is obtained, by simply turning in a common lathe, whilst apertures are left each side of the straps, to give admission for cleaning and oiling, and for checking or stopping the sheave, as fully set forth."

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11. For an *Improvement in Running Gear of Railroad Cars;* Henry Davis Taylor, Newark, New Jersey, February 3.

"This invention relates to certain means of removing obstructions from the track, and preventing the cars, engine, or any carriages employed on railroads, from being caused to run off the track by any unevenness or obstruction, that does not admit of being easily removed, or by any other means."

Claim.—"I do not claim the grooved inclined wheels, J J, fitting to the rails in the manner described; but what I do claim as my invention is, the lower truck or frame, supported upon the rails, and prevented from rising, by grooved inclined wheels, fitting to the edge of the rails, and connected to the trucks and body of the car, by series of links and rods, substantially such as are herein described and represented, operating for the purpose set forth.

"And I also claim the forked guards provided with elastic bands, attached to the lower truck, so as to move up and down freely, but formed so as to take a firm bearing or rest on the front axle, or any stationary part of the front truck, when brought into contact with any obstruction, substantially as and for the purpose herein set forth."

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12. For an *Improvement in Running Gear of Carriages;* Charles F. Verleger, Baltimore, Maryland, February 3.

"The nature of my invention consists in an improved arrangement of the running gear of four-wheeled carriages, whereby I am enabled to produce a light and strong carriage, all four wheels being of equal size, which can be turned round with ease, and without danger of upsetting, in a space of about the diameter of one of the wheels."

Claim.—"Having thus fully described my improved running gear for four-wheeled carriages, and the advantages attained by the same over all others, when the object is to turn in as small a space as possible, without running the fore wheels under the body of the carriage, what I claim as new therein is, the combination of the segment plate *c*, and the perch *e*, sliding thereon and connected with the axles, as described, with the segment plate *h*, forming a part of the perch *e*, and the plate *i*, attached to the perch block of the body, and sliding on the plate *h*, in connexion with the rods *a a*, by which the other parts are regulated and governed in their action, constituting an arrangement of running gear, constructed substantially as in the manner herein fully set forth and represented."

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13. For an *Improved Steering Apparatus;* Norman W. Wheeler, Buffalo, New York, February 3.

Claim.—"Having thus described my improved steering apparatus, what I claim therein as new is, the combination of fast and moving circular racks, of different diameter, with corresponding planet wheels or pinions, connected together and actuated by the hand wheel, as herein set forth."

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14. For an *Improvement in Bridges;* Ammi White, Boston, Massachusetts, February 3.

Claim.—"Having thus described the whole construction of the bridge, I wish it to be understood, that I do not claim, separately, as new, the mode of constructing the stringers, by splicing and securing planks in the manner set forth and shown; nor yet do I claim, separately, the use of diagonal planking, crossed in layers, as described; nor yet, again, do

I claim, by itself, increasing the width of the roadway and other parts of the bridge at the ends; neither the mere employment of side guards or braces; as all these, or similar devices or applications, belong to common carpentry or ordinary bridge building; they, however, are necessary details, or contain principles essential to the construction of my bridge, involving a combination having the effects and advantages specified.

"But what I do claim as my invention is, 1st, The combination of parts, constructed and arranged as described, in formation of a wooden tubular suspension bridge; that is, the several suspension stringers D D, of catenary form, and constructed and united in pieces as explained, (the outer ends of the extreme stringers being locked, as represented in the back stays,) the stringers H H and I, for construction thereto or thereon of the inclined roof, made of diagonal planking; the roadway stringers G G, connected by suspension rods to D D and H H; the direct arch M, united by suspension rods, and further direct arch N, bearing under the upper stringers, together with the transverse floor timbers and roadway; the bridge thus constituted, being formed—that is, its stringers, arches, and coverings—of short pieces of wood, united, and having their fibres running in appropriate directions, as shown, and the bridge being in form wider at its extremities, gradually narrowing towards the centres; by which combination and arrangement of parts, the tensile strength of the wood in the suspension stringers is fully employed, vertical and lateral vibration are reduced, the roof more than assists towards the support of its own weight, and the bridge may be extended over a considerable space.

"2d, The continuous angular side guards formed by fender raves P P, inclined rafters Q Q, diagonal plank covering R R, and extensions of the transverse roadway timbers O O, the said side guards projecting most, and being of greatest extent at the extremities of the bridge, gradually diminishing towards the centre; and the specified side guards serving not only as braces to reduce the lateral motion, but as a covered roadway, and to break the effect of wind upon the structure."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Remarks on the Screw Steamship "City of Pittsburg." By Chief Engineer B. F. Isherwood, U. S. N.

The new steamship *City of Pittsburg*, bought to trade between Philadelphia and Liverpool, has made her first voyage out under steam, and on her return has had the misfortune to break the three blades of her screw propeller. Understanding it to be the intention of her owners to use different proportions for her new screw, it will be of interest to know the performance of the vessel with the old one. The dimensions given in this article were furnished me by her able Engineer; the results were taken from the steam log of the vessel.

HULL.

Length on Deck,	266 feet.
" Water Line,	249 "
Beam on Deck, extreme,	40 " 9 inches.
Depth of Hold,	32 " 6 "
Deep Load of Draft,	$22\frac{1}{2}$ feet forward. 23 feet mean. $23\frac{1}{2}$ feet aft.
Draft with coal half out,	$21\frac{1}{4}$ feet.
Immersed Amidship Section of vessel at $21\frac{1}{4}$ feet draft,	800 square feet.
Burthen, Custom House measurement,	3370 tons.

The hull was originally intended for paddle wheels, and was designed with flat floor and sides, not being the model proper for screw propellers.

ENGINES.

Two vertical trunk condensing engines.

Diameter of Cylinders,	85½	inches.
" Trunks,	39	"
Being equivalent to a cylinder having a diameter of	76·09	"
Stroke of piston,	51	"
Space displacement of both pistons per stroke,	267·392	cubic feet.
Mean effective steam pressure per square inch of piston,	10·4	pounds.
Total power developed by the engines,	777	horses.

SCREW.

One of cast iron; not a *true* screw, but twist bladed.

Diameter,	16 feet 2 inches.
Pitch at hub,	30 "
" periphery,	36 "
Mean pitch in function of total surface,	33 " 6 "
Fraction of pitch used,	0·563
Length on periphery,	5 feet.
" hub.	3 feet 2 inches.
Total helicoidal surface,	126 square feet.
Total surface projected on a plane at right angles to axis,	110·5 " "
Number of blades,	3.

RESULTS.

The vessel steamed from Philadelphia to Liverpool, in November, 1851. Total distance by observation, 3480 geographical miles of 6140 feet. Total time of steaming the above distance, 17 days, 4 hours, or an average of 8·447 geographical miles per hour. Total number of revolutions of the screw, 790,070, or an average of 31·96 per minute. Average steam pressure in the boiler, 10 pounds per square inch above the atmosphere; cut off at $\frac{4}{9}$ths the stroke from the commencement. Throttle one-fourth open. Lift of valve reduced one-half. Vacuum in condenser, per gauge, 19 in. of mercury.

The weather throughout was fine, with an ordinary sea, and a moderate wind forward the beam. No sail set.

Total consumption of fuel, 519 tons, 1677 pounds, or 2825·8 pounds per hour of Cumberland (bituminous) coal.

SLIP OF THE SCREW.

Practically, the effective propelling portion of the screw is about that comprised between the diameters of 6 feet 2 inches, and 16 feet 2 inches, or the exterior 5 feet radially of each blade.

The average pitch of this surface in function of surface is 34 feet.

From the foregoing data, the slip of the screw will be as follows, viz:

$8·447 \times 6140 \quad = 51864·58 =$ speed of vessel per hour in feet.
$34 \times 31·96 \times 60 = 65198·40 =$ " screw " "

$13333·82 =$ slip of screw " " or 20·45 per cent.

BOILERS.

Three iron boilers, of the double return drop flue variety, placed side by side.

Total amount of heating surface, ...	8028 square feet.
" " grate "	226 " "
Aggregate cross area of upper row of flues, . .	28·4 " "
" " " middle " " . . .	37·6 " "
" " " lower " " . .	28·4 " "
Area of smoke chimney, ...	37·6 " "
Height of chimney above grate, . . .	59 feet 6 inches.
Consumption of coal per square foot of grate per hour, .	$12\frac{1}{2}$ pounds.
Pounds of sea water evaporated per hour per pound of coal, inclusive of loss by blowing off, supposing the cylinder pressure to be 7 lbs. per square inch above atmosphere, caused by throttling, ...	4·93 pounds.

PROPORTIONS.

Proportion of heating to grate surface, . . .	35·52 to 1·00
" heating surface per cubic foot of space displacement of both pistons, ...	3·00 "
" heating surface per cubic foot of space displacement of both pistons multiplied by number of double strokes of piston per minute, . .	0·94 "
" grate surface per cubic foot of space displacement of both pistons, ...	0·85 "
" grate surface per cubic foot of space displacement of both pistons multiplied by number of double strokes of piston per minute, . .	0·026 "
" cross area of upper row of flues to grate surface,	7·96 "
" " middle " "	
" " lower " " .	7·96 "
" " chimney to grate surface, . .	6·01 "

The loss by "blowing off" has been calculated on the supposition that the water was carried at $\frac{2}{32}$ of Sewell's Salinometer, with which instrument the boilers were fitted. This is a maximum loss. The evaporation has also been calculated for only 3 lbs. *less* steam pressure in the cylinder than in the boiler; though the steam was wire drawn, both at the throttle, which was but one-fourth open, and at the valve, which had but half its proper lift.

The evaporation obtained of only 4·93 pounds of water per pound of coal, although exceedingly low, was what might have been anticipated from the above proportions, which gave a maximum of heating to grate surface, viz: 35·52 to 1·00, reducing the temperature of the gases delivered into the chimney so low, as necessarily to produce a very sluggish draft; while the proportion of *least* calorimeter, or cross area of flue, to grate surface was only 7·96 to 1·00; a proportion entirely too small, with the low velocity of draft, to supply the proper quantity of atmospheric air for combustion. The inevitable result of such proportions is, that the constituents of the coal is not fully oxidized, and of course a large portion of the products of combustion pass off in the form of carbonic oxide, instead of carbonic acid gas.

Boilers of such proportions should contain double the present amount of grate and heating surface, to supply these engines for driving a screw of the present pitch and surface, in which case a high rate of speed could be obtained.

The present mean effective pressure per square inch of piston is 10·4 pounds, with steam of 7 pounds initial pressure. Supposing now that steam were supplied of 14 pounds initial pressure in the cylinder, cutting

off at $\frac{4}{9}$ths, as at present, and instead of the present vacuum in the condenser, the usual one of 26 inches were carried: the mean effective pressure per square inch of piston would then be 19 pounds; and as the number of double strokes made by the piston (with the same load) is as the square roots of the pressures on it, the double strokes would be increased in the proportion of 31·96 to 43·18, and the speed of the vessel increased from 8·447 to 11·41 geographical miles per hour. The consumption of fuel, with boilers of the same proportions as the present ones, (supposing enough of them to furnish the cylinders with steam of 14 pounds above the atmosphere, cutting off at $\frac{4}{9}$ths,) would be just doubled, or equal to 60 tons of coal per 24 hours steaming. The time of making the passage would be reduced to 12 days, 17 hours, and the consumption of coal for the passage, instead of 520 tons, would be 762 tons.

It is very doubtful, however, if the engines are adapted for making 43 double strokes of piston; and a better result would probably be obtained by making a true screw of 37 feet initial pitch, expanding to 43 feet, being a mean of 40 feet, and adding another blade to compensate the effective surface lost by increasing the pitch, retaining of course the present length of screw on axis, or even increasing it by 6 inches, if practicable. The slip would then remain about the same as at present. The engines have so much cylindrical capacity that, with the increased pitch of screw, they could still, with the above consumption of fuel, develop sufficient power to make the passage in the reduced time stated.

It is of course understood, that the foregoing conclusions do not pretend to critical accuracy; but it is believed they are sufficiently near the truth for any practical purpose.

It has frequently been stated that high speed cannot be obtained with a screw propeller, and an instance challenged where speed has been given by it to a large vessel, equal to the speeds obtained from fast ocean steamships, like the Collins' and Cunard liners; but I think the results furnished from the *City of Pittsburg*, a vessel probably of equal resistance to the steamers of these celebrated lines, will be found as high, comparing them with the actual powers applied to the propelling instruments.

With the Collins' steamers, there is required to make a 10 days 20 hours passage from New York to Liverpool, a mean effective steam pressure of 19 pounds per square inch of piston, furnished by a consumption of about 83 tons of coal per 24 hours, cutting off at $\frac{4}{9}$ths. The space displacement of both pistons per stroke is 888.03 cubic feet. Mean number of double strokes per minute, $14\frac{1}{2}$. Allowing then the mean effective pressure in the cylinders of the *City of Pittsburg* to be 19 pounds per square inch, and the double strokes of piston per minute 43·18, the powers and results would compare as follows, viz:

	Powers.	Speeds.	Cube of Speeds, or Results.
Collins, . . .	1·115	1·039	1·122
City of Pittsburg, . .	1·000	1·000	1·000

The foregoing is, of course, but an approximation obtained from general data; but it is sufficiently close to demonstrate that the screw will, for ocean steamships of very deep draft, give equal speeds with equal power,

compared to the paddle wheel, provided it be properly proportioned and well managed.

The screw has never, to my knowledge, been tried in a first class ocean steamship, with any approximation to the power that is applied to the paddle wheels of such vessels; of course, the reason is obvious why as great speeds have not been obtained.

General Proportions of Power and of Surface of Screw to Immersed Amidship Section of Vessel.

Square feet of immersed amidship section of vessel per cubic foot of space displacement of pistons,			2·992 to 1·000	
Do.	do.	per cubic foot of space displacement of pistons multiplied by number of double strokes of piston per minute,	0·093	"
Do.	do.	per square foot of area of screw, viewed as a disk, ...	7·240	"
Do.	do.	per actual horse power developed by vessel,	1·030	"

For the Journal of the Franklin Institute.

A Series of Lectures on the Telegraph, delivered before the Franklin Institute. Session, 1850–51. *By* Dr. L. Turnbull.

Continued from page 111.

The House Printing Telegraph.

This instrument has been appropriately termed one of the wonders of the age; its apparent intricacy of construction arises not so much from the use of electricity and magnetism, as from the number of minute physical contrivances, and the various methods by which they are brought into action.

Of the origin and life of the inventor, Mr. Royal E. House, it seems difficult to obtain any definite or conclusive information; while the results of his labors are spread before the public, form a prominent object of its curiosity, and are made subservient in a high degree to its utility, the man himself seems almost a recluse, and veiled, as it were, from the sight of the world. If some tell us that he originated in New York, more authentic sources affirm that he was born in Pennsylvania, and reared among the Green Mountains of Vermont. To the old Keystone, then, may we ascribe the honor of having given birth to one who has achieved so much in the progress of American artizanship.

To converse and carry on intelligent discourse at the distance of many hundreds of miles, is not new; nay, it has become common; but to impress with the subtile electric spark through vast space, solid material, with the symbols of our language in the fulness of their proportionate beauty; to make the cold, dull, inanimate steel speak to us in our own tongue, surpasses the mythological narratives of ancient Greece and Rome, throws into the shade the fabulous myths of superstitious Arabia, and sinks into insignificance the time honored traditions of the Oriental World.

A letter dated Boston, Dec. 23, 1850, received in reply to some inquiries, relative to Mr. House, affords the following interesting information: "Mr. House is a self-educated man, and was engaged nearly six years in perfecting his instrument; he is decidedly scientific, but not learned,

having devoted much attention to electricity and its kindred sciences; observing the property of a helix or coil of wire to attract an iron bar to its centre, he proceeded to make some practical application of the fact, and succeeded in constructing what is termed an axial magnet; his principal object then, was the construction of a machine adapted for its use, which he fabricated after many attempts and much perseverance.

Such is the cast of his intellect, that he could form the entire object in his mind, and retain it there until he had completed its whole arrangement, without committing any thing to paper; somewhat abstract in disposition, he is careless about money, little communicative concerning himself, capable of long protracted thought, and completely absorbed in his hobby, the telegraph; to such an extent is this abstraction carried, that he often forgets his most faithful and puctilious business promises, and when sought after to comply with them, is found investigating some interesting object of science, or deeply engrossed in thought; even with particular friends he is very reserved about himself.

From some affection of the eyes he was confined to his dwelling during most of the time spent in contriving his instrument; he resides at present in New York. An application was made for a patent in 1845 or '46, but it was refused on the ground that some of the specifications clashed with those of Mr. Morse; one, however, was granted in October or November of 1848, to date from April 18, 1846.

The stations between which communications are conveyed, are connected by means of a circuit composed of one conducting wire, (see J, fig. 47,) and the ground; the wire is insulated to prevent escape of the electric fluid by enclosing it throughout its whole length in tubes of guttapercha; the heat of the sun melts this covering, or renders it so soft as to destroy its form, and it has been abandoned by all the lines except one; most of them employ, now as at first, the naked wire, supported on glass knobs fixed with bits of muslin to iron spikes driven into the post; they were formerly made of twisted wire and wound around glass knobs; thus exposed to the atmosphere, they soon became oxidized, requiring frequent repairs, or the lightning by striking them often played many pranks with the machines and their operators; the action of the current was also very unequal, owing to the varying electrical conditions of the atmosphere.

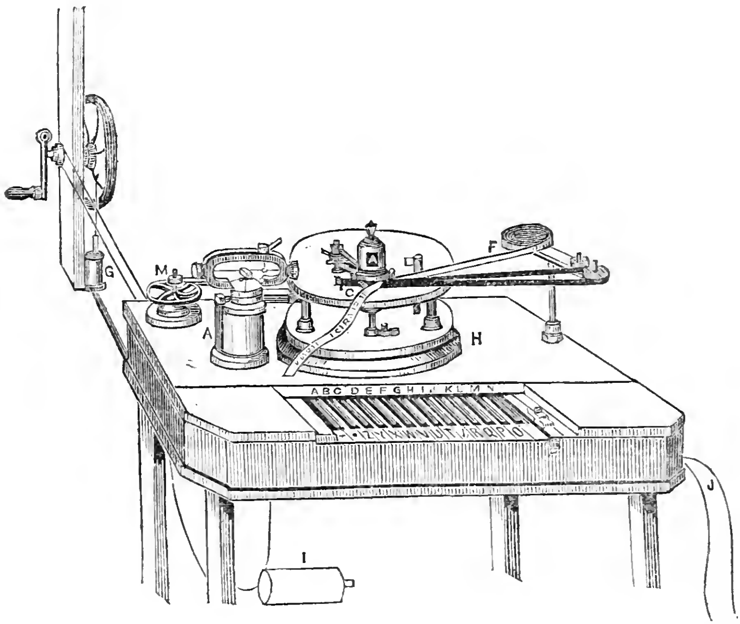
Notwithstanding all their precautions, a severe accident of the above nature, occurred to the House Telegraph in this City, on the 29th of May last; during a severe thunder storm in the afternoon of that day, the lightning, as was supposed, struck the line about six miles from the city; it destroyed nearly three miles of wire, melted off the helix of the magnet here, and terminated with a loud explosion at the battery; several gentlemen were sensibly and severely affected, and one of the operators, Mr. Alexander, received a heavy shock, causing vertigo, ringing in the ears, nausea, and temporary insensibility.

The posts to sustain the wire, are from 20 to 30 feet in height, set 5 feet deep, nine inches in diameter at the base, four and a half at the top, and about 15 rods distant from each other, that being the medium length which the kind of wire cited will support of itself and be durable; the Grove battery is employed to generate the current, of which about thirty cups are necessary for a distance of 100 miles.

The main constituents of his telegraph, are the composing machine, the printing machine, a compound axial magnet, a manual power which sets the two machines in motion, and a letter wheel or tell-tale, from which messages can be read when the printing machine is out of order.

A composing and printing machine are both required at every station; the printing apparatus is entirely distinct from the circuit, but all the composing machines are included in and form part of it; the circuit commences in the galvanic battery of one station, passes along the conductor to another station, through the coil of the axial magnet to an insulated iron frame of the composing machine, thence to a circuit wheel revolving in this frame; it then enters a spring that rubs on the edge of this circuit wheel, and has a connexion with the return wire, along which the electricity goes through another battery back to the station from whence it started, to pursue the same course through the composing machine and magnet there, and all others upon the line; thus the circuit is confined to the composing machines, axial magnets, conducting wires, and batteries.

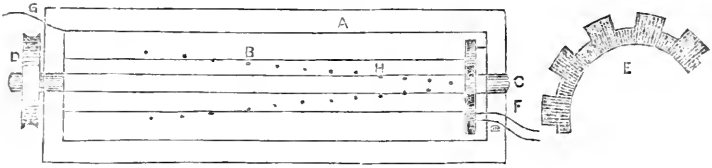
Fig. 47.



The composing machine Fig. 47, is arranged within a mahogany frame H, three feet in length, two in width, and six or ten inches deep; the various parts of the printing machine are seen on the top of the same case; both are propelled by the same manual power, which is distinct from the electric current; it is simply a crank with a pulley carrying a band to drive the machine, and a balance wheel to give stable motion; one of the spokes of the balance wheel has fixed to it, an axis for the end of a vertical shaft to revolve on, that moves the piston of an air condenser G, fastened to the floor; the air is compressed in the chamber I, fourteen inches long,

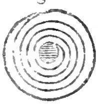
and six in diameter, lying beneath the mahogany case H; it is furnished with a safety-valve, to permit the escape of redundant air not needed in the economy of the machine.

Fig. 48.



The composing system has an insulated iron frame A, Fig. 48, placed immediately below the keys, parallel with the long diameter of the case; this has within it a revolving shaft C; the shaft is enclosed for the greater part of its length by the iron or brass cylinder B; it is made to revolve by a band playing over the pulley D, fixed to the left extremity of it. The cylinder is detached from the shaft, but made to revolve with it by a friction contrivance, consisting of a spiral spring arising from the shaft and pressing against the interior of the cylinder; the spring runs the whole length of the shaft: Fig. 49, shows a transverse section of it; the object of this is to allow the shaft to revolve, while the cylinder can be arrested.

Fig. 49.



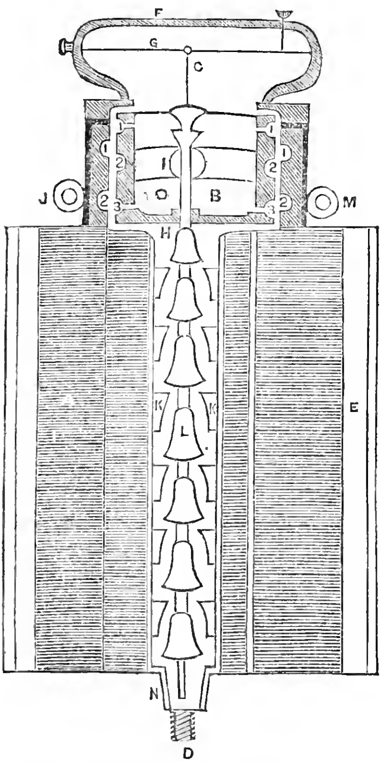
On the right end of the cylinder, is fixed the brass wheel E, Fig. 48, four or five inches in diameter, called the circuit wheel, or break; the outer edge of it is divided into 28 equal spaces, each alternate space being cut away to the depth of one-fourth of an inch, leaving fourteen teeth or segments, and fourteen spaces, Fig. 48, E; the revolving shaft and cylinder form part of the electric circuit; one point of connexion being where the shaft rests on the frame, the other through a spring F, having connexion with the other end of the circuit, pressing on the periphery of the break-wheel E; G, the other part of the circuit coming from the axial magnet to the frame A; if the shaft, cylinder, and circuit wheel revolve, the spring will alternately strike a tooth and pass into an open space; in the former case, the circuit is closed, in the latter it is broken.

For the purpose of arresting the motion of the circuit wheel and cylinder, the latter has two spiral lines of teeth H, fig. 48, extending along its opposite sides, having fourteen in each line, making 28, one for each tooth, and one for each space on the circuit wheel; the cylinder extends the whole width of the key board above it; the latter is like that of a piano-forte, containing twenty-eight keys that correspond with the twenty-eight projections on the cylinder, and have marked on them in order, the alphabet, a dot, and dash, Fig. 47; they are kept in a horizontal position by springs; there is a cam or stop fixed to the under surface of each key directly over one of the projections on the cylinder; these stops do not meet the teeth unless the key is pressed down, which being done, the motion of the cylinder is stopped by their contact; by making the circuit wheel revolve, the circuit is rapidly broken and closed, which continues until a key is depressed; that key being released, the revolution continues until the depression of another key, and so on; the depression of a key either keeps the

circuit broken or closed, as it may happen to be at the time, so that the operator does not break and close the circuit, but merely keeps it stationary for a moment; from one to twenty-eight openings and closings of the circuit take place between the depression of two different keys, or the repetition of the depression of the same one; the object of the composing machine is to rapidly break and close the circuit as many times as there are spaces from any given letter to the next one which it is desired to transmit, counting in alphabetical order.

The rapid electrical pulsations are transmitted by the circuit of conductors to the magnet and printing machine at another station, through the wire J, fig. 47. The helix of this magnet is an intensity coil contained in the steel cylinder A, fig. 47, on the upper surface of the mahogany case; its axis is vertical.

Fig. 50.

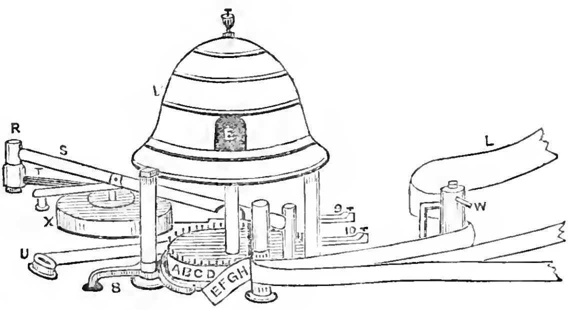


A, fig. 50, is a brass tube, eight or ten inches long, placed within the helix, and fastened at the bottom by the screw D. To the inner surface of this tube are soldered six or eight soft iron tubes, separated from each other at regular intervals. Above the steel cylinder is an elliptical ring, F, through the axis of which is extended an elastic wire, G; two screws are attached to the wire, by which it is made lax or tense, to suit the intensity of the electric current. From this is suspended the brass rod, C, that passes down within the small iron tubes before mentioned, and has strung on it six or eight small iron tubes, L; these are fastened at equal intervals and have their lower extremity expanded into a bell-like flanch; the surrounding fixed ones have their upper ends enlarged inwardly in the same manner. The tubes, L, and the wire to which they are fastened, are movable, so as to come in contact with the small exterior iron tubes K, fig. 50, but are kept separate by the elastic spring above. At E is the brass covering. On the transmission of an electric current through the helix, the tubes become magnetic. Such is the arrangement of their polarities, that they act by attraction and repulsion, overcome the elasticity of the spring, and bring the movable magnets down to the fixed ones;—the current being broken, the spring separates them. The two flanches do not come in direct contact, though the movable one acts responsive to magnetic influence. Most of the magnetism exists at the

flanches, and the order is such that the lower end of the inner tube has south polarity, the surrounding one above, the same, which repels it, while the top of the surrounding one below has north polarity, and attracts it;—this movement is through a space of only one-sixty-fourth part of an inch.

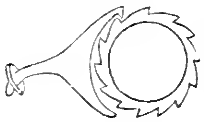
On the same rod, above the movable magnets, is fixed a hollow cylindrical valve, having on its outer circumference the grooves 1, 2, 3, fig. 50, The plate represents a longitudinal half-section of the valve, magnets, and helix. The valve slides in an air chamber, H, which has two grooves, 1, 2, on its inner surface. Air is admitted through the orifice I, by means of a pipe from the air chamber beneath the case, into the middle groove of the valve. The grooves of the chamber open into the side passages J and M, which connect at right angles with a second chamber, in which a piston moves. The movement of the magnets changes the apposition of the grooves in the first chamber, by which air enters from the supply pipe, through one of the side passages, into the second chamber, at the same time that air on the other side of the piston in the second chamber escapes back into the grooves 1 and 2 of the valve, through the other side passage, and from them into the atmosphere. This causes the piston to slide backward and forward with every upward and downward motion of the valve.

Fig. 51.



This piston moves horizontally, and is connected with the lever, 8, Fig. 51, of an escapement, the pallets of which alternately rest on the teeth of an escapement wheel of the printing machine A, Fig. 51. This part of the apparatus is arranged on a circular steel plate, twelve or fourteen inches in diameter, supported by standards on the mahogany frame, H, Fig. 47. The escapement wheel revolves on a vertical shaft that passes through the steel plate, and has fixed on it there a hollow pulley. This pulley contains within it a friction apparatus, precisely similar to that in the cylinder of the composing machine, and is driven by a band running around another pulley, (M, fig. 47.) The pulley can be made to revolve constantly, while the shaft and escapement wheel may be stopped. The escapement wheel has fourteen teeth, each one of which causes two motions of the escapement, which will make twenty-eight for a single revolution of the wheel, which is shown in fig. 52.

Fig. 52.



When in operation, the piston to which the escapement arm 8, fig. 51, is attached, is subjected, on one side or the other, to a pressure of condensed air; therefore the piston and escapement will only be moved by the escapement wheel when the air is removed from one side or the other of the piston. The position of the valve, fig. 50, attached to the magnet regulates the pressure of air on either side of the piston, by opening one or the other of the side passages into the second chamber. By breaking and closing the circuit, therefore, the piston and escapement move backward and forward; thus a single revolution of the circuit wheel at one station opens and closes the circuit twenty-eight times, causing an equal number of movements of the magnets in another station; they carry the valve which alternately changes the air on either side of the piston. This permits the escapement wheel to move the escapement and piston twenty-eight times, and allows one revolution of the escapement wheel for one of the circuit wheel at the transmitting station.

A steel type wheel, fig. 51, A, B, C, D, two inches in diameter, is fixed above, and revolves on the same shaft with the escapement wheel; it has on its circumference twenty-eight equi-distant projections, on which are engraved in order the alphabet, a dot, and a dash. The fourteen notches of the escapement wheel cause twenty-eight vibrations of the escapement in a revolution, that correspond to the characters on the type wheel. Every vibration of the escapement, therefore, makes the type wheel advance one letter; these letters correspond to those on the keys of the composing machine. If any desired letter on the type wheel is placed in a certain position, and a corresponding key in the composing machine is depressed, by raising that key, and again depressing it, the circuit wheel at one station, and the escapement and type wheel at the other station, all make a single revolution, which brings that letter to its former position. Any other letter is brought to this position by pressing down its key in the composing machine, the circuit being broken and closed as many times as there are letters from the last one taken to the letter desired.

To form the letters into words, it is necessary that the printing and composing machines should correspond, and for this purpose a small break and thumb screw, 9. 10, fig. 51, can be made to stop the type wheel at any letter. In sending messages, they usually commence at the dot; if, by accident, the type wheel ceases to coincide with the distant composing machine, the printing becomes confused, the operator stops the type wheel, sets it at the dash, and the printing goes on as before.

Above the type wheel, on the same shaft, is the letter wheel, E, fig. 51, on the circumference of which the letters are painted in the same order with those on the type wheel below. It is encased in a steel hood, having an aperture in it directly over where the letters are printed, so that when the type wheel stops to print a letter, the same letter is made stationary for a moment at the aperture, and is readily distinguished; hence messages can be read, thus making it a visual telegraph.

The type wheel has twenty-eight teeth arranged on the outer edge of its upper surface; near it, on the opposite side from where the printing is done, is the shaft T, fig. 51, revolving in an opposite direction. A steel cap,

X, fig. 51, two inches in diameter, is so attached to the top of this shaft that friction carries it along with it, but it can be moved in the opposite direction; it has a small steel arm, three-fourths of an inch long, projecting from its side, and playing against the teeth on the type wheel; while the latter is revolving, its teeth strike this arm, and give the cap a contrary motion to its shaft. There is a pulley on this shaft, below the plate, connected by a band to M, fig. 47; its speed is less than that of the type wheel. When the type wheel comes to rest, the arm falls between the teeth, but it has not time to do so when they are in motion. On the opposite side of the cap to where the arm is attached are two raised edges, called detent pins, against which the detent arm, U, fig. 51, alternately rests, as the position of the cap is altered by the small arm that plays on the teeth of the type wheel.

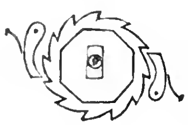
Between the type wheel and cap, is a small lever and thumb screw, 9, fig. 51, which acts as a break on the cap; its motion can be stopped by it, while the type wheel revolves; it is used merely to arrest the printing, though the message may be read from the letter wheel.

The detent arm revolves in a horizontal direction about the vertical shaft, which is also driven by a pulley beneath the steel plate; when the type wheel is at rest, the detent arm rests on one of the detent pins, but when it moves, the teeth on its upper surface give the arm and cap a reverse direction to its shaft, which alters the position of the detent points, so that the detent arm is liberated from this first pin, and falls upon the second, where it remains until the escapement and type wheels again come to rest; when this happens, the arm falls between two of the teeth, the cap resumes its first position, the detent is let loose, makes a revolution, and stops again on the first pin.

The shaft that carries the detent arm has an eccentric wheel R, fig. 51, on it, above the arm; an eccentric wheel is one that has its axis of motion nearer one side than the other, and while revolving, operates like a crank; from this eccentric is a connecting rod S, which draws a toothed wheel against the type; this toothed wheel is supported in an elastic steel arm, (shut out of view by the coloring band,) on the opposite side of the type wheel from that of the eccentric, and revolves in a vertical direction; the band E, fig. 47, carrying the coloring matter to print with, passes between this and the type; the dots seen represent small teeth that catch the paper and draw it along, as the wheel revolves, between itself and a steel clasp, operated by a spring that presses the paper againt the teeth and keeps it smooth; the clasp is perforated in such a manner that the type print through it; there are two rows of teeth, one above, the other below the orifice.

The vertical wheel, fig. 51, is embraced in a ring by the connecting shaft S, and a rotary motion is imparted to it by a ratchet fixed to its lower surface, moving with it and catching against two poles fastened to the steel plate below it; the poles are pressed against the ratchet by springs as shown in fig. 53; the wheel is octagonal, and every revolution of the eccentric, turns it through one-eighth of a revolution, and therefore presents a firm, flat surface to push the paper against the type, and advances sufficient for every letter, one being printed each time the detent arm revolves.

Fig. 53.



When the type wheel stops, the detent arm revolves, that carries with it the eccentric, which through the connecting rod draws the toothed wheel having the paper and coloring band before it against the type, and an impression is made on the paper; a letter is printed if the circuit remains broken or closed longer than one-tenth of a second; about one hundred and sixty letters in the form of Roman Capitals, can be accurately printed per minute; the roll of paper L, fig. 51, is supported on a loose revolving wire frame work; on the same standard is a small pulley W, around which one end of the coloring band runs.

In transmitting a message, the machine is set in motion, a signal is given, (which is simply the movement of the magnet,) and then with the communication before him, the operator commences to play like a pianist on his key board, touching in rapid succession, those keys which are marked with the consecutive letters of the information to be transmitted; on hearing the signal, the operator at the receiving station tells his assistant to turn the crank, setting the machine in motion; then setting his type at the dash, sends back signal that he is ready, and the communication is transmitted; he can leave his machine, and it will print in his absence; when the printing is finished, he tears off the strip which contains it, folds it in an envelope ready to send to any place desired. The Governor's Message has been transmitted by this instrument, and published entire in New York, two hours after its delivery in Albany.

The function of the electric current in this machine, together with the condensed air, is to preserve equal time in the printing and composing machine, that the letters in one may correspond with the other; the electrical pulsations determine the number of spaces or letters which the type wheel is permitted to advance: they must be at least twenty-five per second to prevent the printing machine from acting; the intervals of time the electric currents are allowed to flow unbroken are equal, and the number of magnetic pulsations necessary to indicate a different succession of letters are exceedingly unequal; from A to B, will require one-twenty-eighth of a revolution of the type wheel, and one magnetic pulsation; from A to A, will require an entire revolution of the type wheel and twenty-eight magnetic pulsations.

The first line operating with this instrument was completed in August, 1850, by the Boston and New York Telegraph Company, between those cities, passing through Providence, Norwich, Hartford, and New Haven; they were incorporated with a capital stock of $27,000 by the Legislature of Massachusetts, April 20, 1849; it has also been patented in England, by Jacob Brett, who is extending the lines through that Kingdom.

In reply to an inquiry of mine in regard to the number of lines employing this form of telegraph, I received the following dispatch:—

"The Boston and New York Telegraph Company using House's Printing Telegraph; about six hundred miles of wire; two wires. Stations at Boston, Mass., Providence, R. I., Springfield, Mass., Hartford, Conn., New Haven, Conn., and New York. A line being constructed to connect with the Boston line, running from Springfield, Mass., to Albany, N. York, there intersect the New York and Buffalo line, using the same instruments, extending from New York to Buffalo, a distance of five hundred and seventy miles. One wire now in operation, connecting with

Poughkeepsie, Troy, Albany, Utica, Syracuse, Lyons, Rochester, Albion, Lockport, and Buffalo; and another wire nearly completed, same distance. The same line to continue to St. Louis, Mo., connecting with Cleveland, Cincinnati, Louisville, and St. Louis; will be completed the entire distance by January, 1852, forming the longest line in the world under the direction of one company; whole length being fifteen hundred miles. The New Jersey Magnetic Telegraph Company, using House's instruments, and the first line ever put in operation, extends from Philadelphia to New York; one wire, CXXXII miles; another now being put up.

Respectfully, J. W. PHILIPS."

Subjoined is a specimen of the form of printing executed by this machine, kindly offered by the principal operator at this station, Mr. J. W. Philips, to whom, and the records of the House trial, I am indebted for most of my information.

HOUSES-PRINTING-TELEGRAPH

To be Continued.

Hints on the Principles which should regulate the Forms of Boats and Ships; derived from original Experiments. By Mr. William Bland, *of Sittingbourne, Kent.**

Continued from page 117.

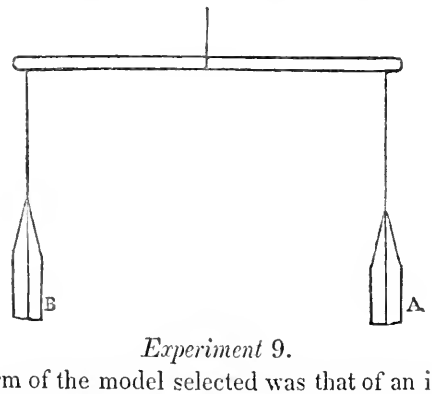
Chapter V.

The whole body of a ship comes next into consideration; and with the view of investigating the same in a perfect and lucid manner, it will be advisable to divide the subject into three parts—as "the Bows," "the Stern," and "the Middle."

Of the Form of the Bows.

The experiments which were put into practice for ascertaining the law relative to the difference of form when exposed to the action of water, are arranged severally as follows. And the diagram beneath exhibits the mode by which the testing of the speed was applied.

The Balance Rod. Scale one-sixteenth.



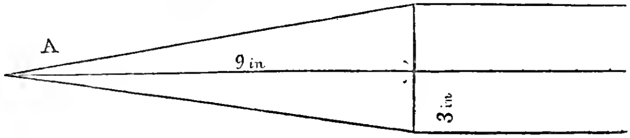
Experiment 9.

First. The form of the model selected was that of an isosceles triangle,

* From the London Architect for September, 1851.

having the perpendicular distance of the base from the apex three times the width of the base.

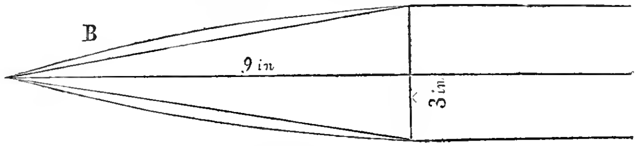
Weight 12 oz. Thickness $1\frac{1}{2}$ inch.



Experiment 10.

Second. This form was an isosceles spherical triangle, of the same perpendicular length and width at the base as the preceding, but having the two sides uniting the base with the apex convex; the curve subtending at the middle of the length one-quarter of an inch beyond the straight lines uniting these two points.

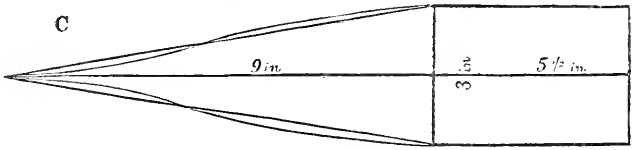
Weight and Thickness as A.



Experiment 11.

Third. The form of an isosceles triangle, with its two sides waved; and the dimensions in other respects the same as models A and B.

Weight and Thickness as B.



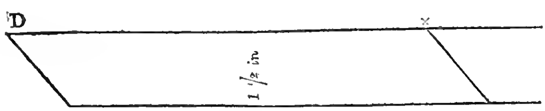
These three models of deal, A, B, C, of the same precise weight, depth, width, and length, were tested on the water against each other, by the balance-rod, and the following results were obtained:

Model B had the greatest speed,
Model A the next,
Model C the least.

But the difference between them was trifling.

Experiment 12.

The model A was then tried against the fourth model D, of the same form of bows, dimensions, and weight, but having its lower isosceles sides beveled off.

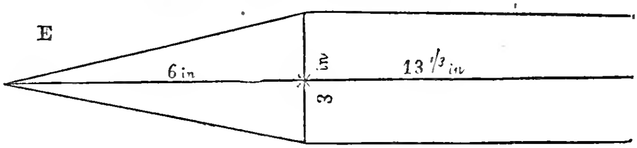


The difference of speed between these two was not perceptible.

Experiment 13.

The next test of bows was with those of less sharpness, and compared first with the sharp-modelled bow A, and then with others of less acute angles.

Weight $14\frac{3}{4}$ oz. Thickness $1\frac{1}{2}$ inch.



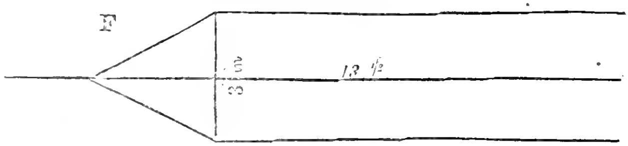
The isosceles triangle form of bows E, had its perpendicular distance from the base 6 inches; yet having the width, depth, and base precisely the same as A.

The conclusion arrived at was, that the speed of A : E : : $6\frac{1}{2}$: 5.

Experiment 14.

The speed of E was then tested with the speed of the model F, having its base and sides equilateral.

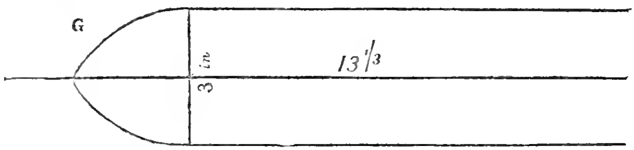
Weight and Thickness as E.



The result gave the speed in favor of E : F : : 3 : 2.

Experiment 15.

The model F was tried against G, a model having its bows a spherical equilateral triangle.

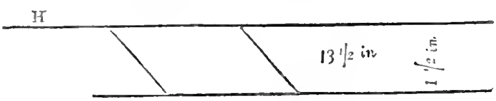


The weight of model G the same as F; the speed in favor of F was F : G : : 6 : $5\frac{1}{2}$.

Experiment 16.

The last test was between the equilateral triangle bows F, and the bows H, of the same dimensions and similitude; but having its isosceles sides beveled off, the angle at the cut water being 45°.

Weight and Thickness as F.



The speed of H was to that of F : : 5 : 4.

The beveled bows of H threw the water off admirably, or rather it may

be said to ride over it, and was always dry during the experiment; whereas F shipped water continually over the bows with the least extra speed.

The conclusions obtained by the experiments in this chapter are, that the more sharp the forms of the bows the less is the resistance from water; and when a gentle curve is given to the bows, the speed is rather improved. Again, by the beveling of short bows, the speed becomes greatly improved; but this is not so apparent in the long and sharp bows. The beveled short bows rode over the water as it were, or at least was in a degree lifted up by it, and therefore did not throw the water up like the perpendicular side bows.

(To be Continued.)

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*Export of Metals from the United Kingdom.**

The Board of Trade returns afford the following detailed account of the quantities of metal of home produce and manufacture exported from the United Kingdom during the month ending the 10th of October last, as compared with the corresponding period of the two previous years:

Metals.		1849.	1850.	1851.
Iron—Pig,	tons	20,309	11,333	18,068
Bar, bolt, and rod,		38,451	44,438	47,094
Wire,		478	457	505
Cast,		1,580	1,812	1,398
Wrought of all sorts,		11,688	14,534	13,680
Steel—Unwrought,		801	1,171	1,334
Copper, in bricks and pigs,	cwts.	19,909	24,189	8,854
Sheets, nails, &c. (including mixed or yellow metal for sheathing,)		26,112	30,373	18,792
Wrought of other sorts,		1,027	491	1,495
Brass of all sorts,		2,593	3,553	2,625
Lead,	tons	2,739	2,345	2,213
Tin—Unwrought,	cwts.	5,315	4,392	2,514
Tin-plates,	value	£78,177	£88,254	£71,386

These returns show that the increased movement in the metal trade, noticed for so long a period, has this month received a rather sensible check. The total value of all the metals comprised in the above table is 797,812*l.* this year, against 893,780*l.* in the corresponding period of 1850, and 830,310*l.* in 1849. There is thus a decrease of 95,968*l.* on 1850, and of 32,498*l.* on 1849. On referring to the various items, we find the falling off to extend to copper, lead, tin, and tin-plates, but it is most evident in the first named article, the exports of copper and brass being only 137,808*l.*, against 243,218*l.* last year, and 210,626*l.* in 1849. Iron, on the other hand, has largely increased, the aggregate figures being 493,705*l.* this year, against 464,018*l.* and 446,213*l.* in the same month of the two previous years. Steel has also increased; the returns for the nine months ending with the same date, give the total exports as follows:—1851, 7,189,107*l.*; 1850, 6,869,076*l.*; 1849, 6,216,420*l.*; so that the aggregate trade of the year, so far as yet ascertained, shows an increase of 320,031*l.*, or 4½ per cent. over the same period of 1850, and an increase of 972,687*l.*, or 15 per cent. over the year before. The foreign trade in iron is proved to be steadily extending, as the demand for foreign

*From the London Mining Journal, No. 847.

railways is more sensibly felt. The iron and steel exports are 4,393,070*l.* in 1851, against 4,020,355*l.* in 1850, and 3,667,348*l.* in 1849. Copper figures for only 1,291,407*l.* against 1,429,773*l.* in 1850, and 1,414,377*l.* in the year previous. In the year's returns of tin-plates and lead there is a considerable increase, so that the falling off of the month is only a trifling reaction, but the decrease in tin is continuous. The exports of foreign and colonial produce for the month ending October 10th, are as follows:

		1849.	1850.	1851.
Copper, unwrought and part wrought,	cwts.	1045	3151	1483
Iron, in bars, unwrought,	tons	571	758	1174
Steel, unwrought,		9	23	168
Lead, pig and sheet,		742	194	298
Spelter,		424	126	205
Tin, in blocks, ingots, bars, or slabs,	cwts.	808	849	1460
Quicksilver,	lbs.	116,527	29,419	67,332

On the nine months we have a great increase in copper, which stands at 22,569 cwts., against 12,428 last year, and 12,447 in 1849. Taking this result in connexion with the diminished export of our home produce, it is evident that the foreign and colonial supplies of this metal are daily becoming of more importance, the working of the copper mines of Australia producing a sensible effect. Iron has slightly fallen off, whilst steel and tin remain at the reduced range of last year, though this last item is recovering. Spelter is steadily decreasing, the figures being only 1509 tons, against 3110 tons last year, and 3632 in 1849. The returns of imports for the month ending October 10, are:

Metals.		1849.	1850.	1851.
Copper ore and regulus,	tons	5627	4174	1805
Copper, unwrought, and part wrought,	cwts.	1015	2807	5360
Iron, in bars, unwrought,	tons	4739	5068	7146
Steel, unwrought,		102		39
Lead, pig and sheet,		1109	695	1356
Spelter,		2371	2269	1468
Tin, in blocks, ingots, bars, or slabs,	cwts.	3967	539	5704
Quicksilver,	lbs.	100,469		

In this instance also, taking the nine months' returns as the basis of comparison, there is exhibited a continuous falling off in the various descriptions of copper, and an increase in iron and steel. Lead and tin have also largely augmented, showing the increased consumption of the country. Spelter has risen to 16,204 tons, against 11,429 last year, and 8722 in 1849; and as the exports of this article are as gradually diminishing, it would appear that the free admission of this metal is bringing it into much more extensive use.

For the Journal of the Franklin Institute.

Boilers of the U. S. Steamship Fulton. By Chief Engineer, B. F. Isherwood, *U. S. Navy.*

Since writing an account of the performance of the *Fulton*, on her trial trip, I have been able to ascertain the performance of her boilers under the ordinary circumstances of sea steaming, burning the fuel with natural draft, and without forcing the fires.

The fuel used was soft anthracite, a mean between the Cumberland coal and the anthracite proper. The data is the average of 11 hours continuous steaming.

BOILERS.—PLATE I.

Two double return drop flue iron boilers, circular from end to end, placed side by side.

Length of each boiler,	22 feet.
Diameter,	10 feet 6 in.
Contents of circumscribing parallelopipedon of each boiler, exclusive of steam chimney,	2425·50 cu. ft.
Area of heating surface in the two boilers,	2600·00 sq. ft.
" grate " "	112·00 "
Cross area of upper and middle row of flues, each, in the 2 boilers,	16·75 "
" lower row of flues, in the two boilers,	17·40 "
" chimney,	21·65 "
Height of chimney above grate,	43·00 feet.
Pressure of steam above atmosphere in boiler per square inch,	24·00 lbs.
Initial steam pressure above atmosphere in cylinder, "	22·30 lbs.
Cutting off at, from commencement of stroke,	3·00 feet.
Number of double strokes of piston per minute,	16.
Consumption of anthracite coal per hour with natural draft,	1342·00 lbs.
Capacity of steam room in boiler and steam pipe,	1210·00 cu. ft.

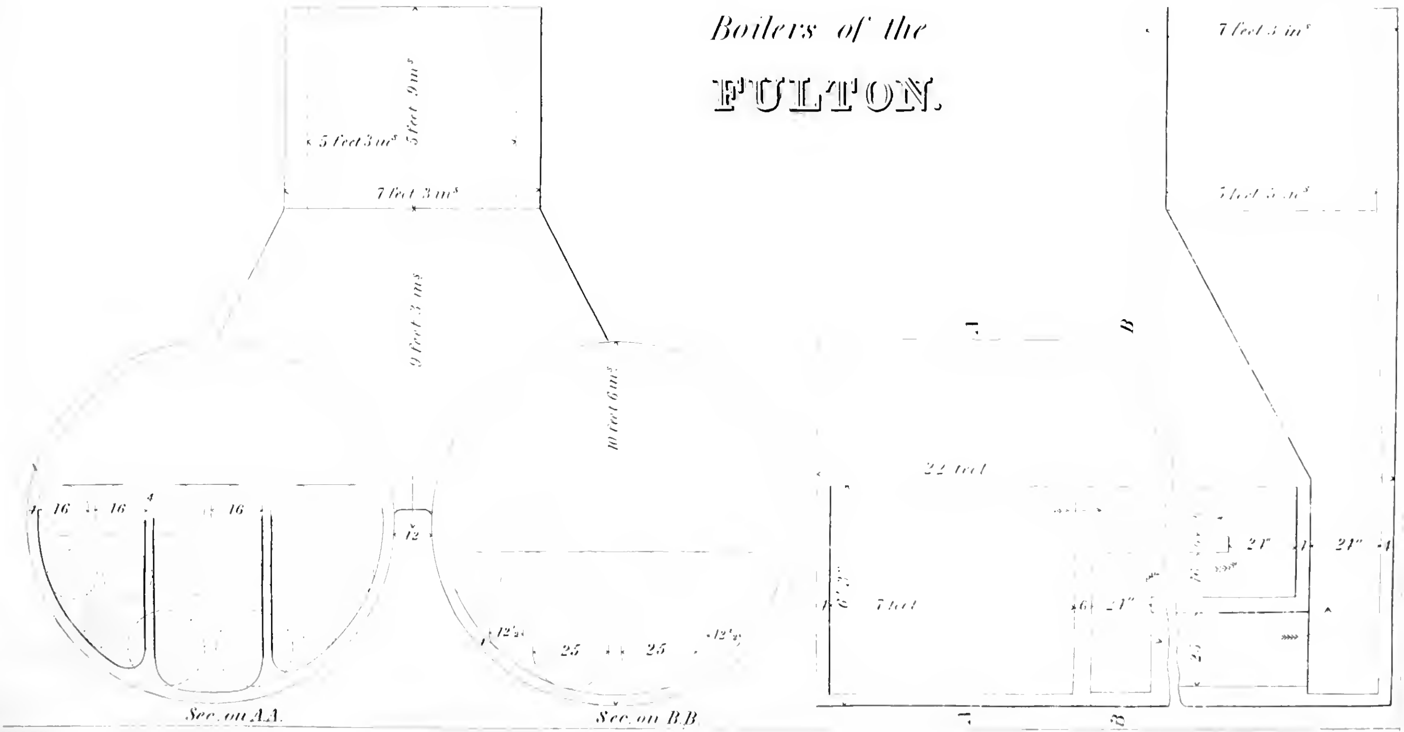
PROPORTIONS.

Proportion of heating to grate surface,	23·214 to 1·000
" grate surface to cross area of upper and middle row of flues, each,	6.687 "
" " lower row of flues,	6.437 "
" " chimney,	5·173 "
" heating surface to cross area of upper and middle row of flues, each,	155·224 "
" " lower row of flues,	149·425 "
" " chimney,	120·092 "
" " per cubic foot of space disp. of piston,	18·453 sq. feet.
" " " per double stroke of pist. per min.	1·153 "
" grate, "	0·050 "
" " " per cu. ft. of space disp. of piston,	0·795 "
Cubic feet of steam room per cubic foot of space displacement of piston,	8·587
Consumption of anthracite coal with natural draft per square foot of grate surface per hour,	12·000 lbs.
" heating "	0·516 "
Sea water evaporated by one pound of anthracite coal per hour,	5·552 "
" " one sq. ft. of heating surface per hour,	2·865 "

Weight of boilers, exclusive of chimney & grates,	111,356 lbs.	
" chimney, jacket, and chains,	7,400 "	
" grates,	5,239 "	
		123,995 "
" sea water in boilers,		82,300 "
Total weight of boilers and water,		206,295 "

In the above calculation of the amount of sea water evaporated per pound of coal, there is nothing allowed for blowing off, as the density of the water is recorded from $\frac{1}{32}$ to $\frac{1.75}{32}$ progressively. There being evaporated per hour 7112·67 pounds of sea water, there would be required over 11 hours steaming to make the density $\frac{2}{32}$, supposing the density at starting to be $\frac{1}{32}$. There has, however, been included in the calculation the quantity of steam (3·094 cubic feet) required to fill the spaces between valves, in nozzles, and clearance of cylinder.

Boilers of the FULTON.



By driving the blowers, the boilers can be made to fill the cylinder to half stroke with steam of 30 pounds per square inch cylinder pressure above the atmosphere, giving the piston a proportionally increased number of strokes. When this is done, however, *foaming* or *priming* takes place.

It may be of advantage to compare the results obtained from the Fulton's boilers with those obtained from the experimental boiler at the Washington Navy Yard, of nearly the same proportions, used by Prof. Walter R. Johnson, in his investigations on coals. The proportions compare as follows, viz:

	Johnson's Boiler.	Fulton's Boiler.
Proportion of heating to grate surface,	26·000 to 1·000	23,214 to 1·000
" grate surface to least calorimeter,	6·449 "	6·687 "
Height of chimney above grate, .	58·000 feet.	43·000 feet.
Pounds of anthracite coal burned per sq. foot of grate per hour with natural draft,	6·430.	12·000.
Pounds of fresh water evaporated per hour per pound of anthracite, from a temperature of 100° F. . .	8·900.	5·713.
Pounds of fresh water evaporated per hour per square foot of heating surface, from a temperature of 100° F. . .	2·060.	2·960.

The above figures show pretty conclusively the advantages to be derived from a slow combustion, in giving time not only for the atmospheric air to become so well mixed with the constituents of the fuel as to completely oxidize them, but also in giving time for the caloric to enter the water, or be taken up by it.

In the above two boilers, we find that with nearly equal proportions of heating to grate surface, nearly double the quantity of fuel is burned per square foot of grate per hour in the Fulton's boiler, while the quantity of water evaporated per square foot of heating surface per hour is only 43·7 per cent. *more;* while the economical evaporation is 35·8 *less.* Now, inasmuch as in one case there is burned double the quantity of fuel per unit of grate per unit of time, than in the other, it is obvious that if the two combustions were equally complete, double the amount of caloric would be evolved in the one case over the other, and if it were proportionally absorbed by the heating surface, double the quantity of water per unit of heating surface per unit of time would be evaporated in the one case over the other; but we find this difference to be practically only 43·7 per cent. more; consequently the caloric, if evolved, could not have been taken up by the heating surface, but must have passed off up the chimney, and by this very passing off up the chimney, produced the increased draft necessary to burn a double amount of fuel.

The potential evaporation of the two boilers per same units may be compared as ($6{\cdot}43 \times 8{\cdot}9$) 57·227 to ($5{\cdot}713 \times 12$) 68·556, or as 1·000 to 1·198; consequently if the grate and heating surfaces of the Fulton's boilers had been one-fifth greater, or 134·4 and 3120 square feet, instead of 112 and 2600 square feet, and half the quantity of fuel burned per unit of grate per unit of time, the same steam power could have been obtained with 35·8 per cent. *less* fuel; making the chimnies of course of equal heights, the draft due to the greater height in Johnson's chimney being one-sixth more than in the Fulton's.

It is not, however, always practicable in a steamship to obtain space for a larger boiler, and economy of fuel must frequently be sacrificed to other considerations. The economical evaporation of the Fulton's boilers is about equal to that of the general average of marine boilers.

In making the comparison *absolutely*, it must be borne in mind, that in the Fulton's boilers there were wastes by leakage of steam through the valves, and by foaming, *not included* in the calculation of their evaporation, while the calculation of the evaporation in Johnson's boilers was made from measurement of the actual amount of water put in them; of course, the calculation was *inclusive* of all losses.

For the Journal of the Franklin Institute.

Reply to the Remarks of J. V. Merrick, Esq., on Screw Propellers. By J. W. Nystrom.

The critique of Mr. J. V. Merrick, in the January number of the Journal, was not seen by me until some time in February. With the greatest respect for Mr. M., it is the principles set forth in his article, and the defence of a theory *not unsupported* by proof and probability, that has called forth the present article.

First, as to the slip of the San Jacinto; I will not contradict the assertions made by reliable witnesses, as I was not there.

Mr. Merrick suggests, first, "a heavy weather at sea, &c." We could as well say a good fair wind, which then would decrease the slip; these are results of circumstances. The assertion that there would be "no difficulty in giving the propeller 50 revolutions," was misunderstood. If the readers of the Journal will examine my statements and formula 11, page 330, last vol., they will see it never entered my thoughts to say *a paddle wheel which makes* 31 *revolutions can, with no difficulty, make* 50. But when the power of the steam engine, and the diameter, pitch, and *slip* of the propeller are given, *from them*, I said there would be no difficulty in giving the propeller 50 revolutions per minute, and the words, "the number of revolutions can *not* be increased ad libitum," prove that my statements were misunderstood. As to the slip being a measure of loss of effect, I supposed the propeller to have no slip, in order to prove that the slip is not a measure of loss of effect; this, I see, has not been fairly understood, and will endeavor to make it plainer. If we say the slip to be determined of 100, and 0—and *in* and *between* those two points, examine the slip, we will find that when the slip is 0, there exists no "recession of the fulcrum against the propeller blades," and the propeller does not act to propel the vessel, but merely runs with it, and there exists no loss of effect. On the other hand, we suppose the slip to be 100, (that is, when the vessel stands stationary, and the propeller is running,) and the slip is a measure of loss of effect as described by Mr. Isherwood, then the slip should take away *all the effect* from the steam engine, and *not allow* any for the friction and working the pumps; still the steam engine runs.

Again, let us take a few steps back, and suppose the slip to be 80 per cent., which is often the case with tow boats; then, if the loss of effect is

80 per cent., there is only twenty per cent. left, which is nothing more than what is required for the friction and working the pumps, consequently nothing left as useful effect for towing; still the vessel is running, and in this age of common sense, we do not believe that witchcraft tows the vessel; take the same tow boat to tow a smaller vessel, which causes a slip of only 50 per cent.; the friction and working the pumps being the same, 20 per cent., then there remains 30 per cent., as useful effect for towing. We see now, that if slip is a measure of loss of effect, it requires more power to propel a small vessel, and no power to propel the largest vessel.

I am obliged to Mr. Merrick, for reminding me what slip is, but would in turn, remind him, that there is as much difference between the slip of a locomotive wheel, and slip of a propeller, as there is between the sleepers and water. I was careful to state, in the article referred to, "*slip in the water.*" The locomotive runs on sleepers; therefore, if Mr. M. will try the experiment with a locomotive in water, he will find it will run as well without the wheels.

In reminding me what slip is, Mr. Merrick says: "slip is a loss of space passed over in a given time; hence a loss of velocity; and therefore, that it is what is commonly called, "loss of effect," or more correctly speaking, loss of useful effect."

Am I so greatly mistaken? or is it necessary, in this Journal, to go back to the school boy's task, and explain the difference between *velocity* and *effect?*

Effect is the *product* of *resistance* and *velocity*. But for screw propellers, this velocity is nothing but the slip of the propeller, or more correctly, the velocity of the pitch, multiplied by the slip. If we again suppose there is no slip, the velocity of the resistance will also be nought; but when we suppose the slip to be the unity, the velocity of the resistance will be equal to the velocity of the pitch. If we say the velocity of the pitch to be $=1$, then the velocity of the resistance will be equal to the slip, and effect equal to the product of the slip and resistance.

When a plane moves in water, perpendicular to the direction of its motion, the *resistance* will be in proportion *nearly as the surface of the plane and square of its velocity;* therefore, effect will be equal to the cube of the velocity multiplied by the surface of the plane; and for screw propellers, the useful effect which propels the vessel, will be measured by the *cube of the slip multiplied by the area of the propeller.*

Expressed in a formula, the effect delivered from the steam engine should be

$$\text{Effect}=A\,S^3$$

which in full, reacts to propel the vessel, with the same effect; or,

$$\text{Effect}=p\,v.$$

See further for explanation of the letters.

If there exists any loss of effect by slip, I *cannot* find where it will be. From observations on propellers, we will find that propellers with more pitch and slip, employ the effect better than propellers with less pitch and slip. See the remarks of Lieut. Gordon, of the R. N., on screw propellers, page 62, last vol. I do not mean to say that slip in itself is any gain of effect, but the gain consists in this, that propellers, with more

pitch and slip, do not require a proportionate power from the steam engine, to give the propellers the same velocity, as propellers with less pitch and slip.

Although there is a limit for the proportions of pitch and diameter, which may be about the former three times the latter.

For the present, we will make a rough sketch in reference to the slip on the *San Jacinto*; the letters will denote,

p=mean thrust given by the dynamometer in pounds; see page 344 last volume.

v=velocity of the vessel in feet per second.

S=velocity of the slip in feet per second.

s=slip of the propeller in a decimal fraction.

r=resistance of the water to the propeller in pounds.

The mechanical effect executed on both sides of the propeller should be equal; then we have

$$p.\ v=r.\ S.$$

$$\text{and } r=\frac{p.\ v.}{S}$$

$$\text{but } v=1-s$$

$$\text{then we obtain } r=\frac{p\,(1-s)}{s}=\frac{p}{s}-p \quad . \quad . \quad . \quad (1.)$$

By reference to Haswell's Pocket Book, on page 229, it says:

"1. That the resistance is nearly as the surface, the resistance increasing but a very little above that proportion in the greater surfaces.

"2. The resistance to the same surface is nearly as the square of the velocity, but gradually increasing more and more above that proportion, as the velocity increases."

At the bottom of page 231, in the table, we find that one square foot having a velocity of 10 feet per second, will sustain a resistance of 112 pounds. From these we obtain the following analogy:

$$10^2 : 112 = A\,S^2 : r$$

$$\text{and } r=\frac{112\,A\,S^2}{100} \quad . \quad . \quad . \quad . \quad (2.)$$

If we, from these formulæ, 1 and 2, calculate the resistance, we should obtain two equal results. A=165 square feet, area of the propeller.

$$S=\frac{968\times26}{60\times74}=5{\cdot}66 \text{ feet per second.}$$

$$p=12{,}815 \text{ pounds.}$$

Formula 1. $$r=\frac{12815}{0{\cdot}26}-12{,}815=36{,}273 \text{ pounds.}$$

Formula 2. $$r=\frac{112\times165\times5{\cdot}66^2}{100}=5900 \text{ pounds.}$$

These two results, which should be equal, *one* is more than *six* times the other. Both of them cannot be right. If we add them together, and divide the sum by two, the mean resistance will be 21,086 pounds. Perhaps that will come nearer the proper one.

In the last volume, on page 403, the formulæ gives the slip to be nearly 38 per cent.; if we, in the same manner as above, calculate the resistance from the formulæ 1 and 2,

$$s=0\cdot38.$$

$$S=\frac{968\times38}{60\times62}=9\cdot9 \text{ feet per second.}$$

Formula 1. $$r=\frac{12815}{0\cdot38}-12815=20{,}900 \text{ pounds.}$$

Formula 2. $$r=\frac{112\times165\times9\cdot9^2}{100}=18{,}100 \quad \text{"}$$

Mean resistance, $=19{,}500$ "

If the slip has been a little over 39 per cent., then it has corresponded with the table in Haswell's Pocket Book, which experiments were made with a plane of only one square foot; but we doubt it will differ so much as in the first instance, with 26 per cent. slip. We leave this to propeller builders for further investigation.

For the Journal of the Franklin Institute.

Performance of the U. S. Screw Steamship San Jacinto, on an Experimental Trip from New York to Norfolk. By Chief Engineer B. F. Isherwood, *U. S. Navy.*

On the 1st January, 1852, the *San Jacinto* left the Navy Yard at Brooklyn, for Norfolk. Her draft of water was 16 feet 10 inches forward, and 17 feet 2 inches aft; mean draft 17 feet. During her passage down the Bay, there was a dead calm and slack tide, the flags at Fort Hamilton drooping from their staves. By observations taken on board the U. S. Steamer *Fulton*, the *San Jacinto* was precisely two hours in going from the Navy Yard to the South West Spit; distance per Coast Survey, 18½ miles, or 9¼ statute miles per hour. By observation on board the ship, however, and by log, she went this distance at the rate of 8 knots of 6140 feet (made that length in this particular case) per hour, or 9·3 statute miles. I shall take the latter speed as most probably correct, being obtained by observation on board; the discrepancy is, however, very small, amounting to only ·05 of a statute mile per hour. The reports of speed were made from the different vessels without communication. The number of revolutions of the screw per minute was 25¼; steam pressure in boiler per square inch above atmosphere, 10 pounds, cut off at half stroke; vacuum in condenser, 24 inches of mercury; throttle three-fourths open; the engines working irregularly, passing one centre very slowly. *Slip of the screw*, 23·71 *per cent.*

After passing outside of Sandy Hook, the mean of four hours steaming was as follows, viz: Speed of vessel, 7 knots per hour; revolutions of the screw per minute, 22¼; steam pressure in boiler above atmosphere, per square inch, 10 pounds; cut off at half stroke; vacuum in condenser,

$24\frac{3}{4}$ inches of mercury; throttle three-fourths open; *very* light head wind, and sea perfectly smooth. *Slip of the screw,* 24·25 *per cent.*

For the next four hours, in continuation, with a light favorable wind, fore and main topsails set, sea smooth, the vessel made $8\frac{1}{2}$ knots per hour; revolutions of the screw, 23 per minute; steam pressure in boiler above atmosphere, per square inch, 10 pounds; cut off at half stroke; vacuum in condenser, 25 inches of mercury; throttle five-eighths open. *Slip of the screw,* 11·02 *per cent.*

The eccentric of the port engine now broke, and it was not until January 3d that the damage was repaired, and the engines got in operation. At starting again, against a very strong wind and head sea, no sail set, the speed of the vessel was $5\frac{1}{4}$ knots per hour; revolutions of the screw, 25 per minute; steam pressure in boiler, 10 pounds per square inch above atmosphere; cut off at one-half stroke; vacuum in condenser, 24 inches of mercury; throttle wide. *Slip of the screw,* 49·43 *per cent.*

Close reefed fore and main topsails being now set, produced no sensible change either in the speed of the vessel or revolutions of the screw.

The wind now (Jan. 5) increased to a very heavy gale, directly ahead, accompanied by a very heavy head sea; no sail set, and vessel pitching and rolling with great violence. Speed, (mean of 12 hours,) 3·52 knots per hour; revolutions of the screw, $22\frac{5}{6}$ per minute; steam pressure in boiler per square inch, above atmosphere, 10 pounds; cut off at one-half stroke; vacuum in condenser, 24 inches of mercury; throttle three-fourths open. *Slip of the screw,* 62·88 *per cent.*

On January 6, with fresh gales abeam and heavy sea, close reefed fore and main topsails set, and ship rolling heavily, the vessel made $4\frac{1}{2}$ knots per hour; revolutions of the screw, 19 per minute; steam pressure in boiler above atmosphere, 5 pounds per square inch; vacuum in condenser, 24 inches of mercury; throttle one-half open. *Slip of the screw,* 42·97 *per cent.*

On January 7, the piston (made of brass) of the port engine broke. This engine was then disconnected, and the vessel worked with the starboard engine alone.

On January 8, there being no wind, and the sea smooth, the vessel made with the one engine alone, $7\frac{1}{2}$ knots per hour; revolutions of the screw, 23 per minute; steam pressure in boiler per square inch, 11 pounds; cut off at one-half stroke; vacuum in condenser, 25 inches of mercury; throttle three-fourths open. *Slip of screw,* 21·48 *per cent.*

The performance of the vessel in heavy weather, "laying to," was as follows, viz: In a heavy head sea, and heavy gales and squalls ahead, with the engines stopped and screw dragging, vessel pitching and rolling violently, close reefed fore and main topsail set, and fore storm staysail; speed, $2\frac{1}{2}$ knots per hour. Under these circumstances, it was difficult to tack or wear the ship, the latter operation requiring 30 minutes. The best sailing ship of her size, under these circumstances of weather, speed, and sail, could have done no better.

With moderate breezes and heavy sea, the vessel made with the above sail, $5\frac{1}{2}$ knots per hour; engines stopped; screw uncoupled, and revolving by its friction on the water.

On arriving at Norfolk, January 8, the vessel's draft was 16 feet forward,

and 16 feet 1 inch aft; mean, 16 feet $\frac{1}{2}$ inch, or $11\frac{1}{2}$ inches less than at starting.

By referring to the previous account of the trial trip of the *San Jacinto*, it will be found that the slip is given on that occasion at 26·27 per cent., with the vessel at the mean draft of 15 feet 8 inches; while on the present passage down New York Bay, the slip was 23·71 per cent., with a mean draft of 17 feet. The stern drafts in the two cases were 15 feet 9 inches, and 17 feet 10 inches, or there was a difference of 2 feet 1 inch in the depth of water on which the screw acted. In the report on the trial trip, I thought the speed of the vessel a little underrated, and that the effect of the "strong wind on the port bow" operated a greater reduction than "one mile per hour." The reporters preferred to err a little on the safe side, rather than risk error in giving the vessel too much speed. At the close of the present trip to Norfolk, the slip was 21·48 per cent., with a mean draft of vessel of 16 feet $\frac{1}{2}$ inch. Taking the mean of the three slips, we have a slip of 23·8 per cent. It will be observed that the Board which fixed the proportions of the screw of the *San Jacinto*, estimated its slip at 22 per cent., a much nearer calculation than that of Mr. Nystrom, who makes the slip 37·7 per cent., and undertakes, in a late number of the *Journal*, to correct their observations of the speed of the vessel, and revolutions of the screw, which determine the slip, by some empirical formulæ invented by himself. Now an empirical formula of any kind will only give correct results so long as *all* the conditions, intrinsic and accidental, of the case on which it was founded, exist *exactly the same* in the case to which it is applied; and it is rather difficult to conceive how formulæ founded on the performance of a few Philadelphia little tug steamers, fitted with Loper's propellers, could apply to a steamship of the size and fine model of the *San Jacinto*, propelled with a screw of the most effective form.

The small slip of the screw of the *San Jacinto*, comparatively to its surface and the resistance of the vessel, is the best illustration of the advantage of a rapidly increasing pitch.

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*Commercial Statistics of Great Britain.**

The information collected by Mr. Braithwaite Poole for his valuable work, certainly exhibits most surprising results. Pitt and Canning stated the yearly production of our agricultural and manufacturing pursuits at an amount equal to the national debt; but nobody knew how they made it out. The summary of these statistics, however, prove that our great statesmen were right; and the comparisons are highly interesting.

Mr. Poole shows that the Railways have cost 240,000,000*l.*; the Canals, 26,000,000*l.*; and the Docks, 30,000,000*l.*

Our Mercantile Marine consists of 35,000 vessels, 4,300,000 tons, with 240,000 men; and one vessel is lost on an average every tide.

Our Navy consists of 585 vessels, 570,000 tons, and 48,000 men. Yachts 520, and 23,000 tons.

The ancient Britons knew only six primitive ores, from which metals

* From the London Mining Journal, No. 847.

were produced; whereas the present scientific generation use fifty. The aggregate yield of minerals in this country is equivalant in value to about 25,000,000*l.* annually.

The Agricultural produce, of milk, meat, eggs, butter, and cheese, 3,000,000 tons, and 50,000,000*l.*

The ale, wine, and spirits consumed annually exceed 3,300,000 tons, and 54,000,000*l.*; whilst sugar, tea, and coffee scarcely reach 450,000 tons, and 27,000,000*l.*

Our Fisheries net 6,000,000*l.* annually.

In Manufactures, the cotton, woolen, linen, and silk altogether amount to 420,000 tons, and 95,000,000*l.*; whilst hardwares exhibit 360,000 tons, and 20,000,000*l.*; in addition to which 1250 tons of pins and needles are made yearly, worth 1,100,000*l.*

Earthenware, 160,000 tons, 3,500,000*l.*; glass, 58,000 tons, 1,680,000*l.*

The Gazette shows an average of four bankrupts daily throughout England and Wales.

In fact, the whole book is full of the best information that could be collected, and should be possessed by all interested in scientific, literary, or commercial pursuits.

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*Trial and Description of Stevens' Patent Fan Paddle.**

On Saturday, December 6, a trial was made of the efficiency of this paddle, which is the invention of Mr. Lee Stevens. It consists of fixed oblique floats on the circumference of the wheel, and diminishing in surface towards the centre, like a lady's fan, which floats or segments, as the wheel revolves, press alternately right and left against the water, and by their oblique action spread the water as it were towards each side, abaft the paddle, and thus materially diminish the back water as compared with the ordinary paddle, and also the vibration on board the boat very considerably. The operation of the paddle is uniformly the same, whether the motion be ahead or astern. The trial above referred to was made entirely at the expense of the Iron Steamboat Company, who had one of their boats, namely, the *Twilight*, fitted with Mr. Stevens' fan floats in a modified form in wood, instead of iron. The inventor expects that when his ideas are carried out by the construction of the fan paddle wheels in iron, as originally intended, their advantage will be still more apparent.

Two vessels belonging to the Company, the *Bridegroom* and the *Twilight*, being twin boats of equal power, having oscillating engines of 12 horse power each, started together from Cadogan-pier with the tide, at a quarter to 2 o'clock, the paddles making 44 revolutions per minute. On reaching Vauxhall Bridge, the *Twilight* was some distance ahead, and on passing Waterloo Bridge, she was still further ahead, having passed it 40 seconds before the *Bridegroom*. On the *Twilight* reaching London Bridge, at five minutes past 2 o'clock, the *Bridegroom* was about three-fourths of the distance between the two bridges behind her. The revolutions of the paddles were at the rate of 44 per minute. On returning up the river against the tide, at 10 minutes past 2 o'clock, the *Bridegroom* was given

* From the London Railway Magazine, No. 653.

the side of the river, which was, of course, an advantage, the *Twilight* being all the time out in the river. The paddles revolved at the rate of 40 per minute, and the boats moved at the same speed until they passed Westminster Bridge; but on passing Vauxhall Bridge, the *Twilight* got considerably ahead, and on passing Chelsea Hospital, at 39 minutes past 2 o'clock, she was about 300 yards ahead of the *Bridegroom*, and the paddles were then making 44 revolutions per minute, until she arrived at Cadogan-pier. It was stated that the number of revolutions of the paddle wheels on board the *Bridegroom* averaged 44½ per minute, and on board the *Twilight* 42 per minute. The vibration in the *Twilight* was scarcely perceptible in the run both up and down the river, which, together with the steadiness of motion produced by the fan paddles, the effect was very agreeable.

It is understood that the fan paddle is to be applied to one of the large sea-going steamers, with a view to increase her speed, and to get rid of the vibration now caused by the ordinary paddles.

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*To Increase the Illuminating Power of Gas.**

In one of your late numbers, you allude to a recent patent for improvements in the manufacture of gas, the object of which is to render the gases resulting from the decomposition of water suitable for lighting purposes, by passing them over cannel coal in the process of distillation. I witnessed some experiments of this nature with the gases obtained from wood in the manufacture of pyroligneous acid, and have myself, for some time past, been making a series, using several descriptions of slightly illuminating gas, but principally those given out by peat and the lowest quality of coals, and the results are highly interesting. I find that a certain volume of such gas when passed through a heated retort containing Lancashire cannel coal, becomes of much greater illuminating power than the same volume of such gas mechanically mixed in a gasholder with the gas given out by the cannel; indeed, some of my experiments show this increase to be at least 50 per cent. when our common coal gas is so treated, as 10,000 feet of it may be passed through the retorts containing a ton of Lancashire cannel in the process of distillation, and the result will be 20,000 feet of gas equal in quality to that given out by the cannel alone, and it incurs no perceptible deterioration by being retained in a gasholder for several days.—C. C.

The Collodion Process in Photography. By FRED. SCOTT ARCHER.†

I am anxious to communicate to those engaged in the Collodion process in Photography an improvement in the manipulation which I believe will be found to facilitate the process considerably. It is, the use of the upright glass bath for the nitrate of silver solution:—and I will endeavor, in as few words as possible, to explain my mode of using it. The bath is about three parts filled with a solution of nitrate of silver of the usual

* From the London Builder, No. 461.

† From the London Athenæum, November, 1851.

strength; and the prepared glass (as soon as the film of collodion has set) is plunged into it. The whole is then placed in its proper position in the camera, the focus having been previously obtained; and the light is thus allowed to act on the prepared film whilst in the bath of nitrate of silver. By this means great cleanliness is preserved in the manipulation, and very delicate pictures are obtained. I have used this bath during the whole of the summer and autumn; and several friends, at my suggestion, have adopted it with great success. The bath is made of two pieces of the best plate glass, connected together at the sides and bottom, and gradually tapering downwards so as to form a narrow wedge-shaped bath, the top being about three-eighths of an inch wide, and the bottom one-eighth. This bath is cemented into a wooden frame, having a closely fitting lid to prevent all dust falling into the solution.

13, *Tavistock Street, Covent Garden.*

A Simple Process for Precipitating the Cotton contained in Collodion. By Thomas Cattell, M. D., *M. R. C. S. Eng. &c., Braunston.**

A short time since, I ascertained that on mixing bisulphuret of carbon with collodion, an immediate precipitation or separation of the cotton takes place, leaving a limpid fluid consisting only of the solvent and precipitant.

The cotton presents the same fibrous appearance as though it had not been in a previous state of solution, and as gun-cotton would do if simply immersed in water. When dried (as much moisture as possible being first pressed out between folds of linen or bibulous paper) it cannot be distinguished from the dried pulp of the paper-maker.

This singular reaction of the bisulphuret on the collodion, would lead to the supposition that the gun-cotton performs the part of a base to the oxyde of ethyl, (ether,) for this substance is at once deprived of the peculiar properties which it possessed previous to solution.

It may serve also to explain more clearly the chemical composition of gun-cotton, or lignine, as acted on by nitric or nitrico-sulphuric acid.

Gutta Percha in Photography.†

At the meeting of the Photographic Club on Saturday last, Mr. Fry exhibited some charming pictures on glass, obtained by a combination of gutta percha and collodion. To the ordinary collodion—gun-cotton dissolved in ether—a small quantity of gutta percha is added, which readily dissolves. This is employed with the ordinary materials for the processes on glass,—the picture being developed by pyro-gallic acid. The extraordinary sensibility of this preparation may be inferred from the fact, that a positive copy from a glass negative has been obtained in five seconds by gas-light. The film formed on glass is far more adherent than the ordinary collodion or albumen:—we may, therefore, expect many valuable results from Mr. Fry's discovery.

*From the London Lancet for February, 1852.

† From the London Athenæum, December, 1851.

Snow Phenomena. *By* W. Gladstone.*

It may interest some of your readers to see the following illustration of the remarkable fall of snow mentioned by Mr. Birt in the *Athenæum* of November the 22d. It occurs in a pamphlet on Meteorology by Prof. Dove, of Berlin,—in relation to the formation of clouds of snow over plains which are situated at a distance from the cooling summits of mountains. He says, that an amateur once gathered together a large assembly in the concert hall of a northern residence. It was one of those icy, star-bright nights which are so aptly called "iron nights" in Sweden. In the room, however, there was a fearful crowd; and the heat was so great that several ladies fainted in consequence. An officer who was present sought to end this distressing state of things by attempting to open a window,—but this was impossible, so hard was it frozen to the sill. Like a second Alexander, he cut the Gordian knot by breaking a pane of glass:—and now, what happened? It *snowed* in the room! It is needless to add any comment on this, as the phenomenon explains itself.

The Planing of Iron and Casting of Glass.†

Messrs. Hawks and Crawshay, of the Gateshead Iron works, have just completed, for Messrs. R. W. Swinburne and Co., plate-glass manufacturers, South Shields, a huge plate of planed cast iron, to be used for the casting of glass. It is, we believe, the largest and heaviest plate of iron that was ever planed. Its dimensions are—length, 18 ft. 4 in.; breadth, 10 ft. 10 in.; depth, $7\frac{1}{4}$ in.; and its weight is 26 tons. Mr. Hosking, Messrs. Hawks and Crawshay's engineer, constructed a planing machine for the express purpose of executing the work; and it has the peculiarity —very dangerous in a joke or an argument, but of great value in a planing machine—of "cutting both ways." A smooth surface and a dead level have been obtained—great merits in a plate for glass casting; for the more perfect the level, the less the labor that is required, and the danger that is incurred, in communicating an even and polished surface to the glass. A smaller plate, weighing 20 tons, (also intended for Messrs. Swinburne's works,) will shortly be placed in the machine.—*Gateshead Observer.*

Cornish Engines.‡

The number of Pumping Engines reported for—

September, is 21; consumption of coal, 1512 tons; water raised, 13,000,000 tons, 10 fathoms high. The average duty of the whole is, therefore, 50,000,000 lbs., lifted one foot high, by the consumption of 94 lbs. of coal.

October, is 20; consumption of coal 1960 tons; water raised, 16,000,000 tons, 10 fathoms high. Average duty, 49,000,000 lbs., lifted one foot high, by 94 lbs. of coal.

November, is 21; consumption of coal, 1525 tons; water raised, 13,000,000 tons, 10 fathoms high. Average duty, 49,000,000 lbs., by 94 lbs. coal.—*Lean's Engine Reporter.*

* From the London Athenæum, December, 1851.

† From the London Mining Register, for December, 1851.

‡ From Herepath's Railway Journal.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, February 19, 1852.

S. V. Merrick, President, in the chair.
John F. Frazer, Treasurer.
Isaac B. Garrigues, Recording Secretary,

The minutes of the last meeting were read and approved.

A communication from Lieut. W. F. Maury, of the Washington Observatory, inviting the co-operation of the Institute on the subject of meteorological observations, was read, and referred to the Committee on Meteorology.

Donations were received from The Royal Astronomical Society, and Chas. T. Beke, Ph. D., London; Hon. James Cooper, U. S. Senate; A. C. Jones, Esq., New Orleans, La.; The Mercantile Library Association, Cincinnati, Ohio; The Maryland Institute for the Promotion of the Mechanic Arts, Baltimore, Md.; The New England Association of Railway Superintendents; T. H. Forsyth, Esq., Penn. Legislature; Lieut. H. S. Stellwagen, U. S. Navy; and Messrs. Theo. Code, John F. Frazer, Tyndale & Mitchell, John C. Trautwine, Oran Colton, and Frederick Fairthorne, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments in the month of January.

The Board of Managers and Standing Committees reported their minutes.

The Committee on the School of Design for Women presented their first Annual Report. On motion, 1000 copies were ordered to be printed for distribution under the authority of that committee.

To the Board of Managers of the Franklin Institute:

The Standing Committee on the School of Design for Women, present their first Annual Report. The establishment of such a branch in the Institute, although entirely cognate to its objects, was undoubtedly a novel and somewhat uncertain undertaking. The nucleus of the School had, however, been formed in an effort made by Mrs. Sarah Peter to enlarge the sphere of female occupation, and the results obtained by the limited means she could command, were so far successful as to warrant an appeal to the Institute to establish, and to the public to endow and support, such an institution.

That appeal was made, and cordially answered on the part of the Institute, and the subscriptions in aid of the School at length reached a sufficient amount to warrant the Committee in opening the School. This was done on the 3d of December, 1850, although the endowment and subscriptions had not reached the sum originally fixed upon as requisite for success. The Committee determined to make the experiment, and assumed the responsibility individually, of arranging its affairs so that it might be continued in operation for at least one year. A suite of rooms in the large building, No. 72 Walnut St., belonging to the American Fire Insurance Company, was rented, and plainly but comfortably furnished. Supplies of a few models, designs, and other elementary matters, were

procured. Mrs. Anne Hill, well known to our citizens as one of the most accomplished instructors in drawing, was elected Principal of the School, and Mr. Charles N. Parmalee engaged as an instructor in Wood Engraving. In a few weeks the School was well filled with pupils, and a rapid and steady progress has crowned the labors of the teachers. Arrangements were made for the reception of pay pupils, and the fee graduated according to the ability of the applicant to pay, but in no case did the charge exceed five dollars per quarter. The most liberal foundation was established for the admission of those whose circumstances did not admit of any return from them for the instruction given. These admissions have been regulated with such scrupulous delicacy and care of the feelings of the applicants, by the ladies of the Committee, that free pupils are known only to them and to the Principal of the School.

Such of the pupils of Mrs. Peter's school as desired to continue, were admitted into our school, and the one established by that lady was then closed. The progress of many of those under our charge was soon sufficient to justify the opening of an industrial department, in which the knowledge imparted in the School might be practically applied. A temporary engagement of Mr. Fillot, as an instructor in the applications of the art of design, was made, and some designs for calicoes, paper hangings, oil cloths, and carpeting produced, evincing considerable skill and taste. After this preliminary trial, Mr. Fillot's connexion with the School ceased, and an arrangement was made with Mr. Thomas W. Braidwood to take charge of the industrial department. The services of this gentleman would have been obtained at the opening of the department, but for other occupations of his, which then precluded him from giving a sufficient portion of his time to our pupils. Since the close of the summer vacation, the School may be said to have received its permanent organization, and to consist of three departments.

First, Drawing, from its elementary principles, through the course of copies from prepared studies, to original compositions, and the applications of coloring, and shading by crayons and pencils, so as to produce complete pictures.

This department is specially under the charge of Mrs. Hill, the Principal of the School, and now contains thirty-two pupils.

Second, The Industrial Department, in which the applications of drawing, shading, and coloring, to the art of design, are taught. In this department, original sketches for designs in calico printing, paper hangings, oil cloths, carpets, furniture, &c., are prepared and offered for sale. Applications are also received from manufacturers and others for the preparation of designs from sketches or ideas furnished by such applicants, so that particular branches of trade, or special tastes, may be consulted with the best promise of advantage or success. Designs and patterns prepared in the School are secured under the copyright law of the United States, which, to the extent that the law gives any security, will protect those who purchase designs from the School in the entire property in such designs, and tend to avoid piracy of the patterns by others. The pupils in this department evince much taste and skill, and all that is now wanting to give it activity and entire success, is a full supply of orders

from our extensive manufactories, which will stimulate the talents of our pupils to the production of original designs, or combinations of existing patterns, equalling any that may come from foreign countries.

This department, as before stated, is now under the charge of Mr. Thomas W. Braidwood, and contains sixteen pupils.

Third, The Department of Wood Engraving and Lithography, with six pupils. In these branches the pupils have made very satisfactory progress, and in the orders for work there has been a good degree of encouragement. Here, as well as in the Industrial Department before noticed, there is abundant room for the display of original talent and taste.

Independently of the constant demand for wood engraving and lithography, for the illustration of works treating on the arts and sciences, and on natural history, there are great outlets for labor in this branch in the embellishment of our periodical literature, and the Committee anticipate that all the pupils who may perfect themselves in the knowledge of these arts, will command constant and well paid employment.

The general arrangements of the School are of the most liberal and comprehensive character.

It has been deemed desirable to instil into the minds of the pupils that, while its doors are freely open to those whose circumstances render them unable to pay for instruction, yet in all cases where a reasonable fee can be paid it should be rendered by the pupil.

So soon as the instruction given fits a pupil for one of the applied departments, she is placed in it, and all her earnings, except a sufficient per centage, (retained to remunerate the School for the cost of the materials, and the use of the tools and implements,) are paid over to her.

The whole number of pupils admitted from December 3, 1850, to January 1, 1852, was 94, and on the last named day, 54 remained in the School.

The amount received for tuition fees to the same time, was $208, and for Designs, Engraving, &c., $448·25.

A particular account of the receipts and payments are herewith submitted in the account of the Treasurer of the School.

We have to regret that, owing to the failure of Messrs. Harnden & Co. to pay an order for forty dollars drawn on them, the proceeds of which were to be invested in the purchase of models, tools, &c., in Europe, we have been rather more limited in our means for instruction than we expected, but the knowledge and experience of our instructors have, to a satisfactory extent, supplied the deficiency.

As Mrs. Sarah Peter, (who is justly entitled to be deemed the founder of the School,) was about to visit Europe, the Committee requested that she would make an examination of the several Schools of Design established there, and on her return report their condition and management, so as to enable us to modify the arrangements of our own School, should we be found deficient in any essential particular.

In order to give to her introduction to such institutions the weight of an official sanction, a formal letter was prepared and delivered to her, under the seal of the Franklin Institute, requesting all in charge of such establishments abroad, to recognise her as the agent of the School, and to further the usefulness of such institutions by a full and free communica-

tion of plans and practical applications. No report has yet been received from her, but enough has reached us of the results of the visits she has already made, to prove that the intelligent philanthropy which suggested the founding of our School, will return to us clothed with an enlarged knowledge and renewed determination to make it quite equal to any she may have examined abroad.

Since the establishment of our School, one of the same character and objects has been opened in the City of Boston, and another has been, or is about to be, founded in the City of New York.

On the first of January last, the question of continuing the School for another year was decided affirmatively by the Committee, under a confident reliance that those who had already patronized the institution by their subscriptions, would again supply the means for its support.

Arrangements are accordingly in progress for a call on the liberal minded of our citizens, for the subscription of a sufficient amount to relieve the Committee from the individual responsibility assumed by them in the opening and maintenance of the School for the past year, and also for such additional subscriptions as will place it on a well endowed and permanent basis.

The grounds for the support of such an institution have been heretofore so thoroughly placed before the public, as to render it unnecessary to reiterate them in this report.

No one claiming a spark of philanthropic feeling, can witness the limited means at the command of women for obtaining a livelihood by labor, without a deep sense of regret, and a consciousness that something should be done to extend those means.

The field we have opened is almost limitless in its capacity, and will grow and increase with the increase of population and wealth. The small amount required for the annual support of such a school, is as nothing, compared with the great advantages flowing from it in a moral and social aspect.

The Schools of Boston and New York are reported to be already very handsomely endowed, and the Committee earnestly hope that the members of the Institute, and the public generally, will, by a visit to the School, and personal examination into its claims and merits, satisfy themselves of its importance and value, and immediately place it, by the liberality of their contributions, on a sure and permanent basis.

Assuming the expenditures of the past year as a basis, and estimating that the receipts for tuition and for work done, will somewhat exceed the amount derived from the same sources in the year 1851, the Committee consider that the sum of three thousand dollars will be wanted for 1852; and for the purpose of procuring said amount, and also for permanently endowing the School, they recommend the adoption of the most energetic measures.

School of Design, *Feb.* 10, 1852.

S. V. Merrick,
D. S. Brown,
F. Fraley,
Sarah V. Merrick,
Mary Lawson,
} *Committee.*

The Committee on the Library reported the regulations under which the pupils of the School of Design for Women will be permitted to take books from the Library of the Institute.

The Committee on the Cabinet of Minerals and Geological specimens, reported that the Heidelberg Collection of Geological Specimens presented at the last meeting, is arranged in the Cabinet, and open for the inspection of the members.

The Trustees of the Elliott Cresson Fund, presented their annual report.

The special committee, appointed to memorialize the City Councils on the security of buildings from fire, and to ask of the Legislature the passage of laws in relation to the construction of buildings in the City and County of Philadelphia, with regard to ventilation and light, reported on the subjects.

Resignations of membership in the Institute (2) were read and accepted.

New candidates for membership in the Institute (21) were proposed, and the candidates (15) proposed at the last meeting were duly elected.

The Standing Committees for the ensuing year were nominated by the President, and appointed as follows:

On the Library.

John Allen,
Spencer Bonsall,
James H. Cresson,
George Erety,
George W. Farr,
Wm. S. Levering,
William A. Rolin,
Jacob D. Sheble,
Clement W. Smith,
Dr. Geo. J. Zeigler.

Cabinet of Models.

George Ashmead,
Job Bartlett,
Harman Baugh,
Henry Huber, Jr.,
Lambert Keating, Jr.,
Henry Newsham,
Charles J. Shain,
John H. Towne,
James A. Wimer,
Charles Welsh.

On Exhibitions.

John Agnew,
John E. Addicks,
H. P. M. Birkinbine,
John C. Cresson,
Geo. W. Conarroe,
Owen Evans,
William T. Forsyth,
William D. Parrish,
Geo. W. Smith,
Alan Wood.

Cabinet of Minerals and Geological Specimens.

John F. Frazer,
Wm. W. Fleming,
Andrew Mayer,
Angus N. Macpherson,
Dr. B. Howard Rand,
Percival Roberts,
Charles E. Smith,
Dr. L. Turnbull,
John C. Trautwine,
Dr. Chas. M. Wetherill.

On Meetings.

Joaquim Bishop,
George N. Eckert,
Robert Frazer,
J. Vaughan Merrick,
Dr. B. Howard Rand,
Geo. W. Smith,
Chas. E. Smith,
John C. Trautwine,
Dr. L. Turnbull,
Dr. C. M. Wetherill.

Cabinet of Arts and Manufactures.

James C. Booth,
Joseph J. Barras,
Charles M. Ghrisky,
William Harris,
Henry H. Kelley,
William P. Troth,
Gustavus L. Thomas,
Eliashib Tracy,
Isaac S. Williams,
Thomas J. Weygandt.

On Meteorology.

Samuel W. Black,
Dr. Silas S. Brooks,
Charles M. Cresson,
Edmund Draper,
Owen Evans,
L. C. Francis,
Dr. David Gilbert,
James A. Kirkpatrick,
Dr. James A. Meigs,
Charles S. Rand.

Dr. Rand, Chairman of the Committee on Meetings, exhibited a model of a new form of artificial leg, the invention of Mr. Jonathan Russel, of this City. Its peculiarity consists in its possessing but a single spring, the power of which, by an ingenious arrangement of attached cords, is made to give the requisite motion and elasticity to the several joints.

In the thigh piece of the leg is attached a cord, which passes down in front of the bolt of the knee joint; in the body of the leg piece, this cord is attached to a spiral spring, from the lower end of which proceed two cords, which pass around a pulley situated just above the ankle joint; one of these cords is attached to the inner and upper side of the foot-piece, while the other, passing under the tenons of the ankle and toe joint, is inserted on the under side of the latter.

Connected with the spiral spring is a bent lever, so arranged that when pressure is made on the toes or heel, its shorter arm is thrown into a notch in the thigh piece, and thus motion in the knee joint prevented, and the leg rendered steady.

Dr. Rand also presented to the notice of the members, an improved apparatus for boring rock, the invention of Mr. John Thomson, of Kensington. The boring rod is attached by a swivel joint at its upper end, to a flat rod twisted at right angles on its own axis, and working through a frame. By drawing up this flat piece, a rotating motion is given to the boring rod, the degree of which may be regulated by adjusting the guiding frame.

Mr. Jonathan Russel exhibited a machine of his own invention, for turning irregular forms to pattern. The three preceding inventions have been submitted to the Committee on Science and the Arts.

Dr. Turnbull brought before the Institute, a very fine specimen of a true delft vase, presented by Messrs. Tyndale & Mitchell, to the cabinet of the Institute. The vase possessed all the characteristics of the true delft ware, being of soft pottery, almost as light as wood, very beautifully ornamented with delicate painted flowers, with leaves and fruit in relief. Dr. Turnbull stated that this kind of pottery was made in Holland, in the 15th century, as a true delft tile in the cabinet has that date upon it, and that the Dutch ware, made at Dalft, was called the parent of pottery. It is the most celebrated, not only on account of its singularity of form and color, but also for its excellent qualities; it is remarkable for the beauty of its enamel, which is not a shining white, but slightly tinged with blue, and presents a smooth and even surface, allowing ornaments of every color to be placed upon without disturbing the enamel, or impairing the brilliancy or distinctness of the colors. The prevailing color is blue, like the tile in the cabinet. The articles of delft ware manufactured for ornaments were chiefly copied from the old Japan porcelain, both in form and color. The hideous imaginary animals of the chimœra class; the three-ringed bottle, the tall and shapeless beaker, and the large circular dish, may still be seen in most collections of Dutch delft. It is to the introduction of the fine English wares, as well as of oriental porcelain, which came into general use in the 17th century in Europe, that the decline of the manufacture of fine pottery is to be attributed. The complicated forms, the fine and delicate paintings required, enhanced too much the price of a ware, of which the materials was less esteemed than that of the new sort which then appeared, so that the fine enamelled, soft pottery ceased to be made in the 17th century, and the manufacture degenerated to very ordinary ware.

Dr. Turnbull also presented to the meeting a specimen of a brick from

the Coliseum at Rome, which Lieut. Stellwagen, U. S. Navy, kindly presented for the cabinet of arts and manufactures of the Institute.

Mr. I. W. P. Lewis, C. E., submitted to the meeting two models, representing a new method of constructing foundations for light-houses, piers, &c., exposed to the force of the sea; also a number of drawings of celebrated light-houses. In describing these, Mr. Lewis demonstrated that there are but two methods of erecting permanent structures of this character; 1st, by opposing "*strength*" to the shock of the sea, as in the case of screw pile foundations; and 2d, by opposing "*weight to weight*," as in the Eddystone, Bell Rock, and other towers.

The stability of all these solid structures is due to their weight, and not to the curvilinear outline, of which so much has been said. Mr. Lewis considered these curved outlines as a useless refinement, and demonstrated the frustum of a cone to be the solid of greatest stability for such purposes. The Bell Rock light-house, he considered as a caricature of the Eddystone, the curved base being carried some five feet beyond the line of pressure of the superstructure. The Skerryvore light-house is another striking example of curved outline, more absurd than any one of the kind. The curve of this tower is a hyperbola, and the cost of executing it in granite, must have added a very large sum to the extravagant cost of the tower. The only reason offered by the architect for adopting this in lieu of a simple conical frustum is, that it would bring the centre of gravity of the tower about "*two feet*" lower.

Mr. Lewis exhibited a drawing of the second Eddystone light-house, erected by John Rudyerd in 1706, as a satisfactory example to prove that weight and simplicity of form are the requisites to ensure stability. Rudyerd's light-house was built of wood in the form of a conic frustum, 61 feet high, 22 feet 8 inches diameter at the base, and 14 feet 3 inches diameter at the top. The timber used was the best of oak, laid stratum superstratum, and ballasted at three intervals with about 356 tons of granite; the strata of ballast being separated by courses of timber. The base was secured to the sloping rock, by cutting horizontal benches thereon, and inserting in the rock, stout iron anchors, the upper parts of which were bolted to the timber. The surface of the tower was formed of upright timber, 9 by 12 inches square, bolted to the interior work, and caulked and pitched like the seams of a ship. This light-house, the construction of which, "Smeaton" eulogizes in very strong language, withstood the fury of the ocean for 46 years, and was then destroyed, not by water, but by fire, being burnt down in 1755.

The present Eddystone light-house, erected 1756-9, by John Smeaton, is a fine specimen of masonry, and is justly looked upon as one of the most remarkable structures in the world; but Smeaton does not give any satisfactory reasons for adopting a curved outline, though this was doubtless suggested to him by the sloping surface of the rock on which he was to build his tower. The building is small, being only 68 feet high, with a diameter of 26 feet on the lowest complete course of the masonry, and 15 feet diameter at the top; its weight is 1817 tons, and the force of a heavy sea falling on its surface at high water, would probably be about 1200 tons, allowing this force to be 6000 lbs. upon a square foot.

The models designed by Mr. Lewis, consisted of a series of cast iron

blocks, moulded into peculiar dove-tailed forms, by means of which several very great advantages are obtained; 1st, a "*vertical band;*" in structures of stone, "horizontal band" is easily obtained, so that each course of masonry may be united as one stone. Such is the peculiarity of Smeaton's Eddystone. But to obtain vertical band in stone masonry, would be attended with extravagant cost and much difficulty. The advantages of such a band are, that during the erection of a tower, none of the blocks could be dislodged from their beds, by any force of the sea, however great this force might be; and when complete, the tower would resist any force on the upper part, tending to break and overthrow it, with the whole strength of its material.

2d, By using cast iron in place of stone, nearly three times the weight is concentrated in each cubic foot of material. Mr. Lewis exhibited a design for a light-house tower, 90 feet high, 25 feet diameter at base, and 14 feet diameter at top; the first 40 feet constructed of two concentric courses of cast iron blocks, dove-tailed together vertically and horizontally, the interior void filled with concrete, and the mass weighing 1531 tons. The superstructure of the tower consisted of cast iron plates lined with a course of brick work, weighing altogether 250 tons, making a total of 1781 tons. The force of the sea striking against the lower 32 feet of the tower, at the rate of 6000 lbs. per square foot, would be 1138 tons, leaving 643 tons surplus weight for the stability.

Discussion took place as to the means of protecting these iron towers against corrosion, &c. Mr. Lewis mentioned the various methods that had been tried, did not consider any of them perfectly satisfactory, but thought (unless a part of the structure was constantly under water,) the iron could be secured against injurious decay. Mr. Tilghman suggested the patent method of coating the iron with fused silicious sand at the moment of casting, which forms a rough but perfect glazing over the iron, and is of course impervious to water.

BIBLIOGRAPHICAL NOTICES.

Appleton's Dictionary of Machines, Mechanics, Engine Work, and Engineering.

Since our former notice of this work, in which we took occasion to express our opinion that the explanation given by the Messrs. Appletons for their omission of Mr. Byrne's name from the title-pages of the book of which he was publicly proclaimed the editor, was unsatisfactory; we have received a letter from Mr. Julius W. Adams, which, after explaining the whole circumstances of the case, closes as follows: "I repeat, *that I, and I alone, superintended, wrote, and collected, collated, composed, examined, and prepared for publication, the second volume of Appleton's Dictionary of Machinery.*" By referring to the January number of this Journal, our readers will see that this makes a direct issue with Mr. Byrne's statement, and the character of Mr. Adams, as well as the well known respectability of the firm of Appleton, entitle him to credit for his assertion. In reference to our final query, it is stated that the first title-page of the second volume

was printed with the first number of the volume, and upon its completion was corrected.

The facts of the case are now before those who take an interest in it, and we leave it with the simple declaration that, whoever edited it, it is a very good book. F.

"Report of the Board of Officers appointed to inquire into the Condition of the Light-House Establishment."

The almost universal complaint of the utter inefficiency of our light-houses, at length led Congress to take measures for an examination into the truth of the reports, and the causes of the defects, if such existed; and the present pamphlet contains extracts from the Report of the Board appointed under the resolution of Congress, and composed of two officers of high rank in the Navy, two officers of Engineers in the Army, the Superintendent of the Coast Survey, and a Lieutenant in the Navy as Secretary.

Their Report discloses a state of things in reference to our light-houses which is highly discreditable to the nation, and requires instant change.

It appears that there is no system whatever, no proper method of determining the position or character of lights; that the lights themselves are of a kind obsolete in Europe, badly placed, badly constructed, badly furnished, and badly tended; that the towers are not always well placed, and are very frequently badly built; and that, with a very low useful effect, our light-houses cost as much as, or more than a proper system of first rate lights.

The remedy proposed is a simple one, the establishment of a permanent Light-House Board, properly constituted, who shall superintend the arrangement of all the lights; employ competent persons to select proper sites, and determine the character of the lights, which are to be of the most efficient construction; competent engineers to design the light-houses and superintend their erection; proper persons to test the quality of the supplies purchased, and to deliver them in proper quantities to the keepers; and finally, shall draw up a set of proper regulations for the light keepers, and see them attended to.

With such a system, we should be extending an efficient protection to the immense foreign and domestic commerce, which is now daily risked along our dangerous and ill-lighted coast, and should thus be doing our duty in a matter which we have heretofore shamefully neglected. It is to be hoped that the proper legislation will at once receive the attention of Congress, and will not be subjected to the usual delays from frivolity and political intriguing.

In a subsequent number, we will copy the conclusions of the Board, for which we have not room at present. F.

Errata.

Page 119, line 24, for "aperture at *a*," read "aperture at *d*."
" 120, " 14, for "increase the width," read "diminish the width."
" " " 25, for "aperture," read "apertures."

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

APRIL, 1852.

CIVIL ENGINEERING.

Philadelphia and Reading Railroad.

Few persons are aware of the magnitude and importance of this work. The following extracts from their published report for the past year, will present at a glance many items of importance.

Travel equal to	57,593	through passengers.
Freight of merchandise,	63,807	tons.
" coal,	1,650,270	"
Wood consumed on road,	61,222	cords.
Coal " anthracite,	5,640	tons.
" " bituminous,	4,023	"

Cost of tallow, lard, grease, and cotton waste,			$10,292·75
Wages of engineers, firemen, conductors, &c., on road,			132,068·02
" workmen in workshops,			175,820·59
Cost of wrought iron and steel used in workshops,			20,652·22
" cast iron	"	"	4,217·03
" copper, tin, spelter, lead	"	"	5,328·76
" timber and lumber	"	"	12,116·70
" anthracite coal	"	"	4,978·54
" bituminous "	"	"	3,610·95
" wheels, axles, and tires	"	"	26,354·93
" hardware, paints, oils, leather, stone, and lime,			13,638·92

Breakage of Coal Cars.

In 1848	1 car	for	every 1485	tons	of coal	carried.
1849	1	"	" 2282	"	"	"
1850	1	"	" 2490	"	"	"
1851	1	"	" 3114	"	"	"

Rails removed from track.

In 1848	1 bar	for	every 266	tons	of coal	carried.
1849	1	"	" 314	"	"	"
1850	1	"	" 332	"	"	"
1851	1	"	" 279	"	"	"

Wear of different kinds of rails per cent. per annum.

	Average of 1848-9.	1850.	1851.	
Old English, 60 lbs. per yard,	6·2	8·3	9·4	heavy track.
" 52 " "	1·4	1·2	2·6	
" 45 " "	1·3	1·4	1·9	light track.
Several superior patterns called Erie,		14·8	17·8	
American Phœnixville, 60 lb. pr. yd.	0·7	4·8	6·3	heavy track.
" Danville, " "			1·7	

Employed on the Road.

	59	first class locomotives.
	20	second "
	7	third "
	3	fourth "
Total,	89	

	1	8-wheel iron coal car.
	2982	4-wheel " "
	1596	4-wheel wooden coal cars.
Total,	4579	

21 8-wheel passenger cars.
5 8-wheel baggage "
2 8-wheel mail and express cars.

STATEMENT E —*Table of Names, Weights, Makers, Condition, and present Duty of all Locomotive Engines owned by the Philadelphia and Reading Railroad Company, November 30, 1851.*

Names.	Class.	Weight.	Maker.		When first ran.		Miles Ran. Past Year.	Miles Ran. Total to Date.	Condition and Duty.
Atlas, . .	1st	27·0	Baldwin,	Philadelphia.	April,	1846	16,206	84,325	At work, Falls Grade.
Hercules, .	"	27·0	do	do	"	"	16,107	80,486	do do
Texas, .	"	22·5	do	do	"	"	20,892	103,914	do in Coal Trade.
Alabama, .	"	22·5	do	do	"	"	20,984	109,990	In shop, under repair.
Kentucky, .	"	22·5	do	do	"	"	22,883	94,631	At work, in Coal Trade.
Indiana, . .	"	21·9	do	do	"	"	15,083	104,733	do do
Princeton, .	"	22·5	do	do	May,	"	25,031	107,068	do do
Montezuma, .	"	22·5	do	do	July,	"	20,945	106,518	do do
Amazon, .	"	22·5	do	do	May,	"	22,758	104,265	do do
Warrior, . .	"	22·5	do	do	"	"	19,853	102,836	In shop, under repair.
Florida, .	"	22·5	do	do	July,	"	21,795	103,680	At work, in Coal Trade.
Washington, .	"	22·5	do	do	June,	"	18,951	94,851	In shop, under repair.
Empire, .	"	22·5	do	do	May,	"	18,310	111,027	At work, in Coal Trade.
Pocahontas, .	"	22·5	do	do	June,	"	15,203	103,394	In shop, under repair.
Yorktown, .	"	22·5	do	do	"	"	21,604	109,135	At work, in Coal Trade.
Rio Grande, .	"	20·1	do	do	July,	"	21,172	100,792	In shop, under repair.
United States,	"	18·6	do	do	"	1844	14,316	129,462	At work, in Coal Trade.
New England,	"	19·7	do	do	"	"	21,300	134,124	do do
New York, .	"	19·1	do	do	August,	"	20,852	137,587	do do
Ontario, . .	"	19·1	do	do	"	"	19,101	137,762	do do
Virginia, .	"	19·1	do	do	September	"	17,264	131,148	do do
Hudson, . .	"	19·6	do	do	October,	"	20,052	112,617	In shop, under repair.
Niagara, .	"	19·6	do	do	April,	1845	19,016	120,764	At work, in Coal Trade.
Pacific, . .	"	19·5	do	do	"	"	20,960	116,180	do do
Independence,	"	19·5	do	do	May,	"	20,931	126,924	do do
Oregon, . .	"	19·5	do	do	"	"	21,271	115,816	de do
St. Lawrence,	"	19·5	do	do	June,	"	21,914	117,125	do do
Constitution, .	"	19·5	do	do	"	"	21,103	98,615	do do
Champlain, .	"	20·1	do	do	September	"	21,460	112,781	do do

STATEMENT E.—(Continued.

Names.	Class.	Weight.	Maker.		When first ran.		Miles Ran. Past Year.	Miles Ran. Total to Date.	Condition and Duty.
Dauphin,	1st	23·7	Baldwin, Philadelphia.		October,	1850	22,212	25,084	At work, in Coal Trade.
Baltic,	"	22·9	do	do	"	"	23,735	27,352	do do
Perry,	"	23·8	do	do	"	"	22,942	27,308	do do
Seminole,	2d	13·1	do	do	Febru'y,	1810	14,051	160,005	do Wood Train.
Baltimore,	1st	28·0	Ross Winans, Baltimore.		June,	1847	12,438	71,525	At work, in Coal Trade.
Maryland,	"	28·0	do	do	September,	"	10,105	56,862	do do
Delaware,	"	28·0	do	do	"	"	16,826	68,560	do do
Ohio,	"	28·0	do	do	"	"	13,454	69,609	In shop, under repair.
Patapsco,	"	24·6	do	do	October,	1850	19,156	23,769	At work, in Coal Trade.
Minesota,	"	22·5	do	do	November,	"	16,670	18,077	In shop, under repair.
Georgia,	"	24·1	do	do	October,	"	23,643	26,713	At work, in Coal Trade.
Louisiana,	"	23·9	do	do	November,	"	21,870	23,985	do do
Mohawk,	1st	19·4	Norris, Schenectady.		October,	"	22,439	21,922	At work, Passenger Train.
Genesee,	"	19·5	do	do	"	"	18,472	21,151	do do
Allegheny,	1st	23·9	Reading Railroad Company.		Novem'r,	1851	381	381	At work, in Coal Trade.
Wyoming,	"	19·6	do	do	Febru'y,	1847	14,115	78,491	do Lateral Railroads.
Palo Alto,	"	20·8	do	do	May,	"	18,474	80,802	do do
Monterey,	"	19·9	do	do	June,	"	18,352	75,980	do do
Saratoga,	"	19·2	Rebuilt by	do	"	1842	12,769	114,500	In order, ready for use.
Mahanoy,	"	20·2	do	do	May,	"	13,291	125,862	do do
Atlantic,	"	20·1	do	do	August,	1844	19,925	113,012	At work, in Coal Trade.
Philadelphia,	"	20·2	do	do	Septem'r,	1851	2,901	2,901	do do
California,	"	21·5	do	do	May,	1848	20,916	63,500	do do
Chesapeake,	"	20·0	do	do	March,	1847	10,971	66,814	do Philadelphia Branch.
Monocacy,	2d	16·4	do	do	"	1842	17,091	173,814	In order, ready for use.
Reading,	"	16·2	do	do	October,	"	10,041	140,577	At work, Roadway Department.
Schuylkill,	"	14·7	do	do	July,	1843	10,906	88,218	do Richmond Wharves.
Osceola,	"	14·8	do	do	August,	"	11,152	79,592	do do
Huron,	"	14·8	do	do	"	"	10,604	90,920	do do
Erie,	"	14·8	do	do	"	"	10,609	91,509	do do
Ontalaunee,	"	14·6	do	do	July,	"	10,877	89,933	do do

STATEMENT E.—(Continued.)

Names.	Class.	Weight.	Maker.	When first ran.		Miles Ran. Past Year.	Miles Ran. Total to Date.	Condition and Duty.
Buena Vista, .	2d	16·9	Reading Railroad Company.	April,	1848	17,473	59,482	In order, ready for use.
Vera Cruz, .	"	16·7	do do	"	"	19,908	83,202	At work, Passenger Train.
Cerro Gordo, .	"	16·8	do do	July,	"	23,330	76,644	do do
Gazelle, .	3d	11·0	Rebuilt by do	March,	1841	14,328	190,436	do Roadway Department.
Atalanta, .	"	10·3	do do	April,	"	22,170	180,732	In shop, under repair.
Antelope, .	"	9·3	do do	June.	1838	8,443	122,030	At work, Valley Passenger Train
Stag, . .	4th	14·6	Reading do	Febru'y	1851	8,901	8,901	do Roadway Department.
Ariel, . .	"	4·3	do do	"	1846	11,093	76,675	In shop, under repair.
Witch, . .	"	5·2	do do	October,	1847	14,557	49,085	At work, Lateral Railroads.
Maine, .	1st	20·0	Boston Locomotive Works.	July,	1849	20,865	48,835	At work, Freight Train.
Massachusetts,	"	20·1	do do	"	"	16,158	45,381	In shop, under repair.
Vermont, .	"	29·2	do do	"	"	25,283	52,515	At work, Freight Train.
Carolina, .	1st	18·3	Newcastle Company.	April,	1846	12,113	74,548	do Lateral Railroads.
Missouri, .	"	18·8	do do	August,	"	17,536	83,111	do do
Columbus, .	"	18·5	do do	April,	1844	8,904	80,775	In shop. under repair.
Tuscarora, .	2d	11·8	do do	Novem'r,	1842	8,375	87,080	At work, Lateral Railroads.
Pennsylvania, .	"	11·4	do do	April,	1843	10,248	86,320	do do
Manatawny,	2d	13·8	Norris, Philadelphia.	October,	1842	11,508	159,388	At work, Extra Train.
America, .	"	13·4	do do	"	"	11,478	140,131	do Wood Train.
Conestoga, .	2d	11·8	Locks and Canals Company.	May,	1843	6,865	85,995	At work, Lateral Railroads.
Shamokin, .	"	11·8	do do	July,	"	5,910	82,987	do do
Potomac, .	"	11·8	do do	August,	"	9,056	103,088	do do
Roanoke, .	"	11·8	do do	Septem'r,	"	6,872	78,164	do do
Engineer, .	3d	8·8	Braithwaite & Co., London.	May,	1838	12,959	141,100	At work, Roadway Department.
Rocket, . .	"	8·4	do do	"	"	12,484	169,957	do do
Planet, .	"	8·4	do do	August,	"	12,454	153,554	do do
Hecla, . .	"	8·4	do do	July,	1840	1,627	135,351	do Lateral Railroads.
Gowan and Marx.	2d	11·0	Eastwick & Harrison, Philadelphia.	January,	"	6,025	101,512	At work, Reading Depot.
Cambridge, .	1st	25·5	Davenport, Bridges & Kirk, Cambridgeport.	June,	1850	16,978	27,010	do in Coal Trade.

Condensed Table, *Showing Condition and Employment of all Engines owned by the Philadelphia and Reading Railroad Company.*

How Employed.	1st. Class.	2d. Class.	3d. Class.	4th. Class.	Total.
In daily use, in good order, on Reading or Lateral Roads,	47	18	6	2	73
In workshops, under Repair,	10	0	1	1	12
In good order, ready for use,	2	2	0	0	4
Totals,	59	20	7	3	89

Statement F.—*Work and Repairs of all Locomotive Engines owned by the Philadelphia and Reading Railroad Company, for the year ending November* 30, 1851.

Miles Ran.

How employed.	Classes.				Total.
	1st.	2d.	3d.	4th.	
Reading Railroad Transportation Department. . . .	990,915	206,660	10,901	21,075	1,229,551
Reading Railroad Roadway Department, ...	13,170		14,597	7,194	34,961
Reading Railroad Renewal Department, ...					
September Freshet, and re-building State Road, . . .	485		36,023		36,508
Total Reading Railroad, . .	1,004,570	206,660	61,521	28,269	1,301,020
On Lateral Roads in Coal Region,	87,757	43,769	22,944	6,282	160,752
Total, ...	1,092,327	250,429	84,465	34,551	1,461,772

Total number of tons hauled 1 mile, exclusive of engine and tender,			366,157,599
Average weight of loaded coal trains down,	"	"	622
" " empty coal trains up,	"	"	208
" " passenger train,	"	"	54

All tons of 2,000 lbs.

COST OF REPAIRS OF ENGINES.

Wages of all mechanics, ...	$61,715 42
Materials, iron, steel, brass, &c., ...	25,173 40
Superintendence, tools, paints, &c., . . .	10,861 10
	$97,749 92

Total number of miles ran by all engines owned and used by Company from May, 1838, to November 30, 1851,	9,371,217
Total number of tons hauled between same dates,	2,140,289,471

Statement G.—*Cost of Repairs and Renewals of Coal, Freight, and Passenger Cars on the Philadelphia and Reading Railroad, for the year ending November* 30, 1851.

COAL, FREIGHT, AND WOOD CARS.

Wages of all mechanics, ...	$79,681 16
Timber, iron, steel, and all metals, ...	60,110 56
Superintendence, tools, paints, oils, &c., . . .	13,979 17
Total,	**$153,770 89**

COST OF REPAIRS OF PASSENGER CARS.

Wages of all mechanics, ...	$3,978 64
Iron, steel, timber, &c., ...	3,528 30
Superintendence, tools, paints, varnish, &c., . .	938 37
Total,	$8,445 31

STATEMENT G.—*Cost of Repairs and Renewals of Coal, Freight, and Passenger Cars on the Philadelphia and Reading Railroad, for the year ending November* 30, 1851.

COAL, FREIGHT, AND WOOD CARS.

Wages of all mechanics, ...	$79,681 16
Timber, iron, steel, and all metals, . . .	60,110 56
Superintendence, tools, paints, oils, &c., . .	13,979 17
Total,	$153,770 89

COST OF REPAIRS OF PASSENGER CARS.

Wages of all mechanics, . .	$3,978 64
Iron, steel, timber, &c., ...	3,528 30
Superintendence, tools, paints, varnish, &c.,	938 37
Total,	$8,445 31

STATEMENT H.—*Items of Cost, in detail, of Hauling Coal on the Philadelphia and Reading Railroad, for the year ending November* 30, 1851.

Per round trip of 190 miles, from Coal Region to Tide Water and back, with empty cars, transporting an average load of 368 tons of Coal each Train.

Items of Cost.	No.	Description.	Average Rate.	Amount.
Wages of Engineer, ...	2	Days.	2·90	5 80
" Fireman, ...	2	"	1·59	3 18
" Conductor, ...	2	"	1·50	3 00
" Brakeman, ...	6	"	1·18	7 08
Wood for Fuel, including Firing up, . .	11·87	Cords.	4.41	52 35
Oil for Engine and Tender, including Lamps,	2·36	Gallons.	·90	2 12
Oil and Tallow for Cars, ...	368	Tons.	·01⅓	4 91
Repairs of Engine and Tender, ...	190	Miles.	8·53	16 20
" Coal Cars, ...	368	Tons.	8·4	30 91
Supplying water, ...	12	M. Gallons.	·06	72
Assistant Engines at Falls Grade . . .	368	Tons.	1·34	4 93
Car Couplers and Greasers, Time-keepers, Dispatchers, and Turning Crews, . .				
Allowance for Engines laying over, Assistant Engines in snow storms, &c., and all other	368	"	1·02	3 75
contingent expenses, ...	368	"	1·87	6 88
Equal to 38·54 cents per Ton.				$141 83

Statement K.—*Items of Cost, in detail, of running Passenger Trains on the Philadelphia and Reading Railroad, for the year ending November* 30, 1851.

Per Daily Trip of 92 Miles.

Items of Cost.	No.	Description.	Average Rate.	Amount.
Wages of Engineer,	1	Day.		2 25
" Fireman,	1	"		1 40
" Conductor,	1	"		1 81
" Baggage Master,	1	"		1 12
" Brakeman,	1	"		1 10
Wood for Fuel, including firing up,	2·6	Cords.	4·46	11 59
Water used,	3	M. Gallons.	·06	18
Oil for Engine and Tender,	·94	Gallons.	·95	89
Oil and Grease for Cars,				59
Repairs of Engine,	92	Miles.	·06	5 52
" and Refitting Cars,				8 04
Hands at Depots, Extra Engines, &c.,				2 62
Sundries for trains,				1 23
Equal to, at 54·8, through Passengers per Train, 69·9 cents per Passenger.				$38 34

Statement L.—*Items of Cost, in detail, of running Freight Trains on the Philadelphia and Reading Railroad, for the Year ending November* 30, 1851.

Items of Cost.	No.	Description.	Average Rate.	Amount.
Wages of Engineer,	1	Day.		2 87
" Fireman,	1	"		1 44
" Conductor,	1	"		1 54
" Brakemen,	3	"	1·21	3 64
Wood for fuel, including Firing up,	4·25	Cords	4·49	19 06
Oil and Tallow, for Engine and Tender,				92
Oil and Grease for Cars,	102·6	Tons.	0·12	1 23
Repairs of Engine and Tender,	92	Miles.	5·42	4 99
" Cars,	102·6	Tons.	16·48	16 91
Depot Hands, and other Depot expenses,				16 08
Water used,	4	M. Gallons.	0·06	25
Renewals of Sundry Articles, Goods damaged, &c.	102·6	Tons.	0·21	2 16
Equal to 69·2 cents per Ton.				$71 09

Statement N.—*Points of Supply, and Distribution of Coal, on the Philadelphia and Reading Railroad, for the Year ending November* 30, 1851.

Amount of Coal received from various Lateral Railroads in Coal Region.

Mount Carbon and Port Carbon Railroad, at Port Carbon, from Valley and Mill Creek Railroads,	500,365
Mount Carbon Railroad at Mount Carbon,	176,512
Mine Hill and Schuylkill Haven Railroad, at Schuylkill Haven,	699,885
Little Schuylkill Railroad at Port Clinton,	273,508
	1,650,270

Where delivered on Line of Reading Railroad.

Station or Turnout.	From Pt. Carbon.	From Mt. Carbon.	From Sch. Haven.	rom Pt. Clinton.	Total.
Orwigsburg,	61	10	166	10	247
Port Clinton,	9				9
Hamburg,	310	62	18	342	732
Mohrsville,	104	5		9	118
Between Morhsville and Reading,	1,056	257	72	199	1,584
Reading,	15,516	3,254	21,936	585	41,291
Birdsboro'	743		410	291	1,444
Douglassville,	487	83	239	19	828
Pottstown,	6,055	146	1,253	293	7,747
Limerick,	112	5			117
Royer's Ford,	479				479
Phœnixville,	5,348	109	1,937	26,148	33,542
Valley Forge,	1,155		509		1,664
Port Kennedy,	5,089	79	4,094	5	9,267
Norristown,	3,516		3,022	436	6,974
Furnaces and Lime-kilns below Norristown,	8,163		770	2,763	11,696
Conshehocken,	11,443	4,176	24,813	10,735	51,167
Spring Mill,	1,868	10	469	8,316	10,663
Manayunk,	652			320	972
Falls,	4,653		9,088	13	13,754
Nicetown & Germantown,	1,959	362		2,271	4,592
Junction with State Road,	3,241	49	2,437	1,011	6,738
Philadelphia,	70,483	3,758	83,407	61,761	219,409
Richmond,	357,863	164,147	545,245	157,981	1,225,236
Totals,	500,365	176,512	699,885	273,508	1,650,270

TABLE, *Showing the Business of the Philadelphia and Reading Railroad* (*each item monthly*) *for the Year ending November* 30, 1851.

Date.	Travel.	Freight on Goods.	Freight on Coal.	U. S. Mail.	Miscella. Receipts.	Total.
December, 1850.	10,379·32	6,068·93	216,418·93	783·33	526·20	234,176·71
January, 1851.	10,421·62	16,086·47	168,839·99	783·33	930·71	197,062·12
February,	7,720·70	13,852·13	105,600·24	783·34	620·87	128,577·28
March,	10,312·21	9,530·76	135,873·67	783·33	896·88	157,396·85
April,	13,978·49	11,203·62	174,761·73	783·33	857·77	201,584·94
May,	14,296·67	10,448·71	164,484·89	783·34	609·01	190,622·62
June,	13,417·65	7,890·88	147,972·46	783·33	544·36	170,608·68
July,	16,115·98	8,346·50	151,396·88	783·33	598·57	180,241·26
August,	15,558·53	9,671·62	190,699·71	783·34	571·23	217,284·43
September,	14,692·99	10,620·54	186,565·80	783·33	618·88	213,281·54
October,	14,318·07	11,187·23	195,895·43	783·33	559·49	222,773·55
November,	11,189·11	8,764·95	177,361·06	783·34	2,621·66	200,720·42
Totals,	152,431·64	123,672·34	2,018,870·79	9,400·00	9,955·63	2,314,330·40

COAL TONNAGE.

December, 1850,	145,290 $\frac{3}{20}$	June, 1851,	129,526
January, 1851,	114,077 $\frac{1}{20}$	July,	141,972 $\frac{10}{20}$
February,	71,601	August,	173,717 $\frac{16}{20}$
March,	102,501 $\frac{6}{20}$	September,	165,730 $\frac{2}{20}$
April,	134,366 $\frac{6}{20}$	October,	178,821 $\frac{7}{20}$
May,	137,162 $\frac{2}{20}$	November,	155,504 $\frac{7}{20}$
		Total,	1,650,270

ANTHRACITE COAL TRADE OF THE UNITED STATES.

The following Table exhibits the quantity of Anthracite Coal sent to market from the different regions of Pennsylvania from the commencement of the Trade, in 1820, to 1851 inclusive; together with the Annual Increase, &c., and the Importations of Foreign Bituminous Coal.

Years	SCHUYLKILL. Canal.	Railroad.	Total.	Pine-grove.	Little Schuylkill.	LEHIGH. Total	OTHER REGIONS. Lacka-wana.	Wilkes-barre.	Sham'kin	Lykens Valley.	Aggregate.	Annual increase.	Consump-tion.	Sold on line of Schuy'll.	Import of foreign coal.
1820	—	—	—	—	—	365	—	—	—	—	365	—	—	—	—
1821	—	—	—	—	—	1,073	—	—	—	—	1,073	—	—	—	22,122
1822	—	—	—	—	—	2,240	—	—	—	—	2,240	—	—	—	34,523
1823	—	—	—	—	—	5,823	—	—	—	—	5,823	—	—	—	30,433
1824	—	—	—	—	—	9,541	—	—	—	—	9,541	—	—	—	7,228
1825	6,500	—	6,500	—	—	28,393	—	—	—	—	34,893	25,352	—	—	25,645
1826	16,767	—	16,767	—	—	31,280	—	—	—	—	48,047	13,154	—	—	35,665
1827	31,360	—	31,360	—	—	32,074	—	—	—	—	63,434	15,837	—	—	40,257
1828	47,281	—	47,284	—	—	30,232	—	—	—	—	77,516	14,082	—	3,154	32,302
1829	79,973	—	79,973	—	—	25,110	7,000	—	—	—	112,083	34,567	—	3,332	45,393
1830	89,984	—	89,984	—	—	41,750	43,000	—	—	—	174,734	12,651	—	5,321	58,136
1831	81,854	—	81,854	—	—	40,966	54,000	—	—	—	176,820	2,086	177,000	6,150	36,509
1832	209,271	—	209,271	—	14,000	70,000	84,600	—	—	—	363,871	187,051	298,871	10,048	72,978
1833	252,971	—	252,971	—	40,000	123,000	111,777	—	—	—	487,748	123,877	434,986	13,429	92,432
1834	226,692	—	226,692	—	34,000	106,244	43,700	—	—	—	376,636	*decrease.*	415,186	19,429	71,626
1835	339,508	—	339,508	—	41,000	131,250	90,000	—	—	—	560,758	184,122	635,935	18,571	49,969
1836	432,045	—	432,045	—	35,000	148,211	103,861	—	—	—	682,428	121,670	632,428	17,863	108,432
1837	523,152	—	523,152	17,000	31,000	223,902	115,387	—	—	—	881,476	199,048	680,441	21,749	153,450
1838	433,875	—	433,875	13,000	13,000	213,615	78,207	—	—	—	739,293	*decrease.*	788,968	28,775	129,083
1839	442,608	—	442,608	20,639	9,000	221,025	122,300	—	11,930	—	819,327	80,034	867,000	30,390	181,551
1840	452,291	—	452,291	23,860	20,000	225,318	148,470	—	15,505	—	865,414	46,087	973,136	28,024	162,867
1841	584,692	850	584,692	17,653	40·000	143,037	192,270	—	21,463	—	958,899	93,485	958,899	41,223	155,394
1842	491,602	49,902	540,892	32,381	37,000	272,516	205,253	47,346	10,000	—	1,108,001	149,102	1,158,001	40,584	141,521
1843	447,058	230,254	677,295	22,905	31,000	267,793	227,605	58,000	10,000	—	1,263,539	155,538	1,263,539	34,619	41,163
1844	398,887	441,491	839,934	34,916	57,000	377,002	251,005	114,906	13,087	—	1,631,669	368,130	1,631,669	60,000	87,073
1845	263,587	820,237	1,083,796	47,928	74,000	429,453	273,435	178,401	10,000	—	2,023,052	391,383	2,023,052	90,000	85,776
1846	3,440	1,233,142	1,237,002	58,926	91,000	523,002	320,000	192,503	12,572	—	2,343,992	320,940	2,343,992	155,460	156,853
1847	222,693	1,360,681	1,583,374	67,457	106,401	643,973	388,203	284,398	14,904	—	2,982,309	638,317	2,782,309	226,610	148,021
1848	436,602	1,216,233	1,652,835	61,530	162,626	680,746	437,500	237,271	19,356	—	3,089,238	106,929	2,889,238	252,837	196,168
1849	489,208	1,115,918	1,605,126	78,299	174,758	801,246	454,240	259,080	19,650	25,325	3,242,866	153,403	3,125,000	239,290	198,213
1850	288,030	1,423,977	1,712,007	70,919	211,960	722,622	550,417	243,250	19,921	37,763	3,356,614	114,033	4,183,725	207,863	180,439
1851	579,156	1,605,084	2,184,240	—	310,307	989,296	795,095	336,000	24,899	54,200	4,383,899	1,026,831	—	312,367	—
	7,870,618	9,485,710	17,367,328	560,413	1,531,052	7,562,028	5,094,385	1,951,734	193,287	116,338	32,864,735				

On the Discharge of Water over Weirs and Overfalls. By Thomas Evans Blackwell, *M. Inst. C. E.**

Additional Observations, forming Columns 1, 9, *and* 10 *in the Original Tables, Kennet and Avon Canal.*

Continued from page 88.

Thickness of sheet of water taken at the outer edge of overfall plank, or, where there was a wide crest, at the outer end of such crest.

The 1st column is the total depth of water above crest, as given in the tables.

The 2d column shows the height the water rose against a 2-ft rule held flatways against stream.

The 3d column shows the height the water rose against the brass slide of a rule held edgeways.

Heighth above crest.	Flat Rule.	Edge Rule.
	Table III.	
1	1	$\frac{5}{8}$
1	1	$\frac{5}{8}$
4	4	3
4	$4\frac{1}{4}$	$2\frac{11}{16}$
5	5	$3\frac{1}{2}$
5	5	$3\frac{1}{2}$
6	6	$4\frac{3}{8}$
6	6	$4\frac{3}{8}$
8		$6\frac{3}{8}$
	Table IV.	
2	$1\frac{1}{4}$	
3	3	$1\frac{15}{16}$
4	5	$3\frac{1}{2}$
5		$3\frac{5}{9}$
6		$4\frac{3}{9}$
7	$5\frac{1}{8}$	
8	$6\frac{1}{3}$	
9	$6\frac{3}{4}$	
	Table VII.	
1	$1\frac{1}{2}$	$\frac{1}{4}$
4	6	$1\frac{1}{2}$
6	8	1
7	9	$2\frac{3}{8}$
	Table VIII.	
4	$5\frac{1}{2}$	$1\frac{3}{8}$
5	7	$1\frac{3}{4}$
7	8	$2\frac{1}{8}$

Heighth above crest.	Flat Rule.	Edge Rule.
	Table IX.	
$\frac{7}{8}$ to 1	$1\frac{1}{2}$	$\frac{5}{16}$
2	$3\frac{3}{4}$	$\frac{9}{16}$
2 .	$3\frac{1}{2}$	$\frac{9}{16}$
4	5	$1\frac{1}{2}$
6	$8\frac{1}{4}$	$2\frac{1}{4}$
8	9	$3\frac{1}{2}$
	Table X.	
1	1	$\frac{7}{16}$
2	2	$\frac{7}{8}$
4	$4\frac{1}{2}$	$1\frac{3}{8}$
5	5	$2\frac{1}{4}$
6	6	$2\frac{1}{8}$
6	6	$2\frac{1}{8}$
	Table XI.	
1 to $1\frac{1}{4}$	$1\frac{1}{8}$	$\frac{1}{2}$
3	3	$1\frac{1}{8}$
3	$2\frac{7}{8}$	$1\frac{1}{2}$
6	6	$2\frac{3}{4}$
9	$8\frac{1}{4}$	$4\frac{1}{8}$
	Table XII.	
1	$\frac{7}{8}$	$\frac{7}{16}$
2	2	$\frac{7}{8}$
2	2	$\frac{13}{16}$
5	5	$1\frac{3}{4}$
6	6	$2\frac{5}{8}$
8	$7\frac{1}{2}$	$3\frac{5}{8}$
9	$8\frac{1}{2}$	$3\frac{1}{2}$
10	9	4

One of the general laws that appears to be indicated by these experi-

ments, is that in thin plates, the coefficient is highest at the smallest head observed, and that it reaches the mean, at a head of about 3 inches; after which it continues to decrease as the head increases.

For a plank 2 inches thick (which represents the ordinary form of waste-board,) these experiments show, that beginning with a head of 1 inch, the coefficient is less than the mean; that it reaches its mean earlier, as the length of the weir is greater, being in average cases at about the head of 3 inches; and that it then rises higher than its mean, till it reaches the head of about 9 inches; when it is again depressed below the mean.

One remarkable circumstance was found to prevail in a great number of these experiments, viz., that the head of about 4 inches gave a less quantity than could be arrived at by interpolating the results of the experiments with heads of 3 inches and 5 inches. It is not easy to explain the causes tending to produce this depression; but the fact was striking and well established.

A similar result occurred, at about the same head, in the other set of experiments made at Chew Magna.

A few experiments, which were made for ascertaining the effect of converging wing-walls, will demonstrate the great advantages known to be attendant on such a form, as will be seen by comparing the results on the weir of 10 feet in length with and without such wings. The mean coefficients for the two cases were 371 without, and 459 with the wings; the splay of the wings being an angle of 54°.

The circumstance attending the set of experiments at Chew Magna makes the discharges of them analogous to the case of a weir in a river, or in a running stream; but among themselves there are anomalies equally remarkable with those on the canal. The overfall bar was here invariably 2 inches thick, and the length was always 10 feet. The coefficients, up to a head of 3 inches, are below the mean; above that head they fluctuate considerably; but generally they keep above the main line. These anomalies are difficult to account for; the experiments having been very carefully made, and such causes of error as might have arisen are not sufficient to explain them; they are therefore left as facts, to be added to, or elucidated, by the researches of others.

Appendix.

Table *showing the Variation of the Coefficients for different Species of Overfall.*

Species of Overfall.	Length in feet.	Mean Coefficients. m.	k.
Thin Plate,	3	·421	·080
"	10	·145	·086
Plank 2 inches wide,	3	·380	·073
" "	6	·377	·072
" "	10	.371	·072
" " (with wings,)	10	·459	·090
Bar 2 inches wide, (Chew Magna,)	10	·480	
Crest 3 feet wide, slope 1 in 12,	3	·338	·065
" " 1 in 18,	3	·339	·065
" " "	10	·337	·065
" " Level,	3	·311	·060
" " "	6	·322	·061
" " "	10	·314	·061

Table showing the Variations of the Coefficients for different Heads of Water.

Number of Experiments, and Species of Overfalls.	Mean Coefficient (m,) applicable to Formula (I.)		Mean Coefficient (k.) applicable to Formula (II.)	
	Head in Inches.	Coeff't.	Head in Inches.	Coeff't.
6. Thin plate 3 feet long, . .	1 to 3	·440	1 to 2	·085
	3 " 6	·402	3 " 6	·078
11. Thin plate 10 feet long, . .	1 " 3	·501	1 " 3	·096
	3 " 6	·435	3 " 6	·086
	6 " 9	·370	6 " 9	·072
23. Plank 2 inches thick, 3 feet long,	1 " 3	·342	1 " 3	·066
	3 " 6	·384	3 " 6	·074
	6 " 10	·406	6 " 10	·077
56. Plank 2 inches thick, 6 feet long,	1 " 3	·359	1 " 3	·069
	3 " 6	·396	3 " 6	·077
	6 " 9	·392	6 " 9	·074
	9 " 14	·358	9 " 14	·069
40. Plank 2 inches thick, 10 feet long,	1 " 3	·316	1 " 3	·068
	3 " 6	·397	3 " 6	·076
	6 " 7	·374	6 " 7	·072
	9 " 12	·356	9 " 12	·069
4. Plank 2 inches thick, (with wings,) 10 feet wide,	1 " 2	·476	1 " 2	·092
	4 " 5	·442	4 " 5	·087
7. Overfall with crest 3 feet wide, sloping 1 in 12, 3 feet long,	1 " 3	·342	1 " 3	·066
	3 " 6	·328	3 " 6	·063
	6 " 9	·341	0 " 6	·066
9. Overfall with crest 3 feet wide, sloping 1 in 18, 3 feet long,	1 " 3	·362	1 " 3	·070
	3 " 6	·315	3 " 6	·061
	6 " 9	·332	6 " 9	·064
6. Overfall with crest 3 feet wide, sloping 1 in 18, 10 feet long,	1 " 4	·328	1 " 4	·063
	4 " 8	·350	4 " 8	·068
14. Overfall with crest 3 feet wide, level, 6 feet long,	1 " 3	·305	1 " 3	·059
	3 " 6	·311	3 " 6	·060
	6 " 9	·318	6 " 9	·061
15. Overfall with crest 3 feet wide, level, 6 feet long,	3 " 7	·330	3 " 7	·062
	7 " 12	·310	7 " 12	·060
12. Overfall with crest 3 feet wide, level, 10 feet long,	1 " 5	·306	1 " 5	·059
	5 " 8	·327	5 " 8	·063
	8 " 10	·313	8 " 10	·061
61. Chew Magna. Overfall bar, 2 inches thick, 10 feet long,	1 " 3	·437		
	3 " 6	·499		
	6 " 9	·505		

Mr. Blackwell, having explained the tables and the diagrams illustrating the paper, stated that his object in bringing the subject before the Institution had been, to make known certain recorded facts; and he conceived that from these experiments some useful deductions might be drawn, which he trusted would induce other members to make similar investigations.

Mr. Simpson said, the experiments at Chew Magna were undertaken to settle a question, as to the discharge from some reservoirs connected with the Bristol waterworks. These were always kept to a nearly uniform level; but as the water was discharged by a sluice, 19 feet in height, at the rate of about 4 feet per second, there was a slight agitation of the water in the reservoir which would account for some of the anomalies in

the experiments alluded to by Mr. Blackwell. On the whole, he did not think these anomalies were greater than was met with in similar cases, when the country was precipitous, and the water was delivered from a high reservoir into a still pool, and then gauged through notch boards. The Wynford brook, on which the reservoir at Chew Magna was situated, fell about 90 feet in a mile, and floods had been recorded which discharged seventy times the ordinary flow of water. The experiments had been carefully made, and gave, he believed, correct results in all cases.

Mr. J. Scott Russell thought Mr. Blackwell's experiments had been conducted in a most useful manner, and on a sufficiently large scale to be applicable to general practice; and he would rank them higher, and considered them more trustworthy, than those made by Du Buat and D'Aubuisson; as those made by Du Buat, though on a large scale, were far from the truth, and those by D'Aubuisson, though better in character, were made on too small a scale to be of practical utility. As far as he had been able to understand Mr. Blackwell's formula, nothing more was meant by it than the nearest approach to a general law, and the difference between it and each practical experiment being ascertained, showed how much the coefficient required to be altered so that the formula and the experiment might coincide. Then the mean of the coefficients of that class of experiments might be taken as a general coefficient for that class, and the difference between it and the coefficient in each experiment would be the measure of discrepancy between the two. The experiments differed so considerably from one another, that the method adopted was the only rational one; because if they took any isolated experiment, and put it down as a fact to be followed in other cases, it would lead to erroneous conclusions. He believed, therefore, the mean of the coefficient was the only thing which would represent the truth, so far as it resulted from experiment. The first table exhibited seemed to him to show, not so much the law of overflow, as the deviations from the supposed law; whilst the diagram appeared to show the law which the delivery followed, as determined by the height of head, under different circumstances of breadth of overfall. And the two together conveyed to his mind a very simple and clear view of the results of all the experiments which had been compared together, so that in order to apply these results to practice, it was only necessary to take the height of head, as given in that table, and the quantity discharged by a unit of breadth, and then to judge which of these most nearly approached the case under consideration. With regard to the discrepancies, which had been noticed by Mr. Blackwell, in the Chew Magna experiments, he believed they might be attributed to the variations of the velocity, caused by the current of the stream entering the reservoir; for he had himself seen, in a reservoir 120 feet wide, that a small stream running into it with a velocity of 4 feet per second, caused the water in the reservoir to be disturbed for a distance of 100 feeet; indeed, formed a distinct current for that distance. This proved how necessary it was to notice every minute fact when recording each observation. It would be a great boon to the profession, if the members of the Institution would make a point of transmitting the results of experiments on any question; and it was exactly that kind of contribution which the younger members could make with so much certainty, and with so much advantage to themselves and the profession; for whilst, on the

one hand, the collection of well authenticated facts induced a habit of accurate research; on the other hand, it brought to the older and more experienced members, the means of drawing general conclusions, and of deducing correct rules from actual experiments.

Mr. Hawksley coincided with the expression of the general value of the results of the experiments, as a record of observed facts. He thought, however, that these experiments had been made under such widely different circumstances, that they would not be available for the determination of a satisfactory formula. He had also made a considerable number of experiments, to determine the value of the coefficient to be used with the ordinary formula, for measuring the flow of water over a "notch-board." These experiments were made on a brook, in which six gauge boards were fixed, having notches, edged with iron, and of different widths and depths. The velocity of the current in the pond, above each notch, was reduced as much as possible, and the water discharged, after passing successively over all the boards, was at last accurately weighed, by a machine constructed for the purpose. Each notch of necessity discharged the same quantity of water in the same time; consequently, if the formula employed by Mr. Hawksley was correct, it must necessarily give the same result over all the differently formed notches, and finally coincide with the determination of the quantity by the process of weighing. This was so nearly the fact, that the maximum error did not exceed one-sixteenth part of the whole. On some future occasion he would take an opportunity of placing these and other hydraulic investigations, before the members of the Institution.

Mr. Cawley believed, that if the diagrams exhibited by Mr. Blackwell were carefully studied, the discrepancies, which at first sight seemed to exist, would vanish, and they would be found to be attributable, almost invariably, to friction. Where the water passed over a thin plate, there was comparatively little or no friction at the sides, and therefore the coefficient would accurately represent the discharge for every width of overfall; but when the height of the head of water was greater, or the overfall had wings, the case was different, as then there would be a considerable amount of friction, varying, of course, with different circumstances.

Mr. S. Ballard stated, that in September, 1836, he had made a series of experiments, for Mr. T. Rhodes, on the flow of water over weirs, on the river Severn, at Powick, near Worcester. These experiments were made with a weir 2 feet long, formed by a board standing perpendicularly across a trough. The results are given in the following table:—

Depth of Water flowing over the Weir, in inches.	Cubic Feet per Minute over 1 foot of Weir.	Depth of Water flowing over the Weir, in inches.	Cubic Feet per Minute over 1 foot of Weir.
1	5·88	4	46·87
$1\frac{1}{4}$	7·14	$4\frac{1}{4}$	49·45
$1\frac{1}{2}$	9·55	$4\frac{1}{2}$	54·87
$1\frac{3}{4}$	12·37	$4\frac{3}{4}$	59·60
2	14·93	5	63·38
$2\frac{1}{4}$	18·29	$5\frac{1}{4}$	66·17
$2\frac{1}{2}$	23·07	$5\frac{1}{2}$	73·17
$2\frac{3}{4}$	27·69	$5\frac{3}{4}$	77·58
3	32·14	6	82·56
$3\frac{1}{4}$	34·61	7	102·27
$3\frac{1}{2}$	37·81	8	126·76
$3\frac{3}{4}$	41·47		

At the commencement of these experiments, satisfactory results could

not be obtained, on account of the difficulty of observing the exact depth of water on the weir, for a gauge, which had been set up at the side, did not clearly show the height, owing to the capillary attraction. The method then adopted was to attach two needles to the lower end of an accurately graduated gauge, one of which was a very little longer than the other, so that on the water being admitted by a sluice regulated by a screw, its level was adjusted until it just touched the longest needle, and occasionally, by its uneven motions, the shortest needle, and thus the exact height of the water above the weir was observed. The water, after passing over the weir, fell into a square tank, capable of holding 300 cubic feet, in which a gauge, graduated so as to show every 10 feet of water, was fixed. This gauge had a floating guard around it for keeping the water still, so that the exact height could be taken; and for the purpose of showing clearly when the water arrived at each 10 feet mark, a pin was placed at right angles to the gauge, and the instant the water touched, it was immediately seen. As it was thought that the perpendicular position of the board forming the weir might have some effect in diminishing the quantity of water passing over it, a sloping board, inclining on the upper side, from the top of the weir downwards, was substituted, when the quantity of water discharged was increased, with 1 inch depth of water, from 5·88 cubic feet per minute to 6·76 cubic feet per minute, or about 15 per cent. Experiments were subsequently made with a weir of only one foot long, when the quantity of water discharged was less, in proportion, than it was with the 2 feet weirs. This was attributed to the contracted stream caused by the direction of the course of the water at the sides of the weir. Experiments were also tried with oblique weirs, and circular weirs, and the result was, that the quantity of water discharged was in proportion to the length of the weir.

Extract from the Report to the Secretary of the Treasury on Light-Houses of the United States.

The Board, after examining, with a patience and a zeal which they believe this important branch of the public service to demand, the different points to which their attention was specially called by the instructions of the Department, have arrived at the following conclusions, which they feel assured will be found to be fully sustained by the detailed data in this report, and its appendix, upon which they are chiefly based:

1. That the light-houses, light-vessels, beacons, and buoys, and their accessories in the United States, are not as efficient as the interests of commerce, navigation, and humanity demand; and that they do not compare favorably with similar aids to navigation in Europe in general, but especially with those of France and Great Britain, and their dependencies.

That the light-house establishment of the United States does not compare favorably in economy with those of Great Britain and France.

That, while the superiority of the European lights to those of the United States, (arising from the greater care and attention bestowed upon them, the better and more expensive apparatus employed in them, the larger number of keepers to the lights, the more rigid superintendence

and frequent visitations for inspections and for delivery of supplies,) renders any just comparison of them in annual expense in money impossible; it is shown that the difference for maintenance per lamp per annum is very small, and that not invariably in favor of those of this country.

That the towers and buildings have not been constructed in general of the best materials, nor under the care and supervision of competent or faithful engineers.

That the want of professional knowledge of the materials, mortars, cements, &c., &c., for construction and repairs, or faithfulness on the part of those charged with the duty, was apparent in nearly all the modern towers and buildings visited by the Board.

That the present large sums annually required for renewing, renovating, and repairing towers and buildings, are the consequences of the want of an efficient organization, which could afford the necessary professional ability for plans, drawings, and superintending of constructions and repairs.

That the towers are deficient in the necessary proper accommodations for oil and other supplies; in the mode of fitting them up, and in the materials employed for the interior work; and the buildings ill adapted to the comfortable accommodation of the keepers.

That the lanterns are, as a general rule, of improper dimensions, constructed of ill-adapted, and, in the end, not economical materials, without professional or scientific skill; and, in many instances, not suited to the use for which they are designed.

That there is no proper system of ventilation for lanterns.

That the means said to be employed for ventilating are wholly inadequate, and contrary to true scientific principles.

That there is very little attention paid to the painting of the interior of the lanterns and astragals, and in glazing.

That, under a well organized system, the lights and other aids to navigation might be greatly increased in number and efficiency, at a large saving upon the present annual cost.

That there has never been an efficient systematic plan of construction, illumination, inspection, and superintendence of lights, &c., &c., in the United States.

That towers and buildings have been constructed without regard to the wants of the service, and to the peculiarites of localities, and the special design of the lights themselves.

That the light-house towers, buildings, and vessels visited by the Board were not, in general, found to be in a creditable state of preservation and repair.

That the inferiority of illuminating apparatus in the light-houses of the United States renders its renewal frequently necessary, at great expense, and never produces as effective a light as it is capable of making.

That the reflector apparatus employed in the light-houses of the United States is greatly inferior to the requirements of the service, being defective in form, materials, and finish.

That the illuminating apparatus in the United States is of a description now nearly obsolete throughout all maritime countries, where the best

apparatus of that description was employed, prior to the introduction of the Fresnel lenses, as substitutes.

That the sea-coast reflector lights are, in general, too low, and are deficient in power and range.

That our sea-coast reflector lights are not fitted with a sufficent number of lamps and reflectors to produce the greatest amount of usefulness, which the imperfect system of lighting with the reflectors will produce.

That the lamps and reflectors are not, as a general rule, properly placed on the frames, due regard not being paid to divergency.

That the sea-coast lights are deficient in proper attendance, with only one keeper.

That there is no proper classification of lights in the United States.

That the lights are not properly and sufficiently well distinguished along the coast of the United States.

That there is no system of public inspection and superintendence, calculated to render the light-house establishment moderately useful or efficient.

That the lanterns, illuminating apparatus, &c., are not superintended, while they are being made, by competent or faithful professional men.

That there are no general or special regulations for keepers and others connected with light-houses, by which to insure an intelligent or faithful performance of the duties.

That supplies of all kinds, involving the good or bad quality of the lights to a great extent, are not tested and selected by competent persons before issuing them to light keepers.

That there is not a proper degree of responsibility on the part of the agents connected with the light-house establishment.

That the present mode of procuring and distributing supplies, apparatus, &c., is not calculated to insure either efficiency or economy in the service.

That contractors are not held under a sufficiently rigid superintendence and inspection during the execution of works of construction and repair.

That the modern light-house towers are inferior in point of materials and workmanship to the older ones visited by the Board; such, for example, as Sandy Hook light-house, built in 1762; Cape Henlopen tower, built in 1764; Cape Henry tower, built in 1791.

That the floating lights of the United States are comparatively useless, for want of efficient lamps and parabolic reflectors.

That the light vessels are in general not adapted to the service they are required to perform, being defective in size, model, and moorings.

That the light vessels are not properly distinguished either by day or by night.

That sufficient regard has not been had to the proposed use of the several lights, so as to regulate their power and range accordingly.

That there is no effective system by which to afford to sparsely settled parts of the coasts requiring lights, the means of bringing the subject before Congress, and of deciding in advance of appropriations the best descriptions of lights to be placed at the desired points.

That many of the small lights have an unnecessary number of lamps and reflectors, while sea-coast lights are greatly deficient in them.

That in the form and adjustment of the reflectors, sufficient attention is not paid to the range and other circumstances of the required lights, involving scientific principles.

That there is not, in useful effect, a single first class light on the coast of the United States.

That the lights at Navesink (two lenses), and the second order lens light at Sankaty Head, Nantucket, are the best lights on the coast of the United States.

That there are very few, if any, reflector lights on the coasts of the United States better in useful effect than the third order lens light (larger model) erected by the Topographical bureau on Brandywine shoal, while the economy of the lens light is in the ratio of at least 4 to 1.

That the lens lights at Navesink, Sankaty Head, and Brandywine shoal are considered to be, as a general rule, equal to European lights of the same classes.

That the Fresnel lens is greatly superior to any other mode of light-house illumination, and in point of economy is nearly four times as advantageous as the best system of reflectors and Argand lamps.

That the buoys in the waters of the United States are defective in size, shape, and distinction, as a general rule; and that sufficient care is not taken, nor competent persons employed, to place, moor, and replace them.

That the moorings of buoys are not sufficiently heavy, and the chains not properly tested as to size and strength.

That the sea-coast lights along the southern coast from the highlands of Navesink, are comparatively useless to the mariner for want of sufficient power and range.

That the dangerous obstructions to navigation around Cape Florida, from the Gulf of Mexico, are not properly lighted and otherwise marked to aid navigators.

That the entire southern coast of the United States requires additional lights and other aids to navigation, to render human life and property safe.

That, for want of an efficient organization, there is no systematic plan adopted on any part of the coast of the United States for rendering navigation safe and easy by means of lights, beacons, buoys, &c., &c.

That lights and other aids to navigation are provided, as a general rule, through the action of Congress upon petitions emanating from persons having a local interest, or from boards of pilots, insurance offices, chambers of commerce, &c., &c.

That under a proper organization, the officers of the light-house establishment would collect information from reliable sources, decide upon the doubtful points, and recommend to Congress all cases of sufficient importance to warrant appropriations.

That the approaches to some of our principal and most important harbors, bays, &c., are not sufficiently lighted and marked to render steam navigation as rapid, easy, and safe, as the wants of commerce demand, especially to New York, Delaware, and Chesapeake bays, and some of their tributaries.

That the duty of lighting and marking with beacons, buoys, and sea-marks, our extended sea, lake, gulf, bay, sound, and river coast, efficiently

and economically, can only be performed by persons of professional experience and undoubted ability upon a systematic plan, based upon the principles of the most approved light-house engineering.

That there is no efficient system of inspection and superintendence of lights in the United States.

That the light-keepers, in many cases, are not competent, and in no instances have they been instructed in reference to their duties, nor examined to ascertain their ability to perform the duties faithfully.

That the supplies of oil, chimneys, wicks, &c., &c., are not tested and selected with sufficient care, or by competent or faithful agents.

That there is no proper system of distributing the supplies to light keepers.

That proper attention is not given to purchasing and distributing supplies.

That the cleaning powder used in our light-houses is injurious to the reflectors, and not such as is used in other light-house establishments; and other articles are equally defective.

That there is no system in the management of the light-house establishment of the United States.

That the instructions to light-keepers to light, trim, and extinguish the lights at certain specified times are not enforced, to the detriment of the service, and to the imminent risk of endangering vessels in their vicinity.

That such knowledge is not imparted to light-keepers, as a general rule, to enable them to keep their lamps, burners, reflectors, and lanterns in such order as to insure the best lights from the existing apparatus.

That frequent and rigid inspections and superintendence by competent persons are necessary to insure an efficient and economical light-house service.

That competent keepers, responsible to the Government through inspectors, are indispensable to insure good lights at all times.

That supplies are not delivered at sufficiently short intervals of time to the lights.

That the present mode of repairing illuminating apparatus, oil tanks, &c., &c., is not economical, efficient, or reliable.

That the removal and replacing of light vessels, the extinguishment or lighting of lights, removal or placing of buoys, &c., or in any manner changing lights and other aids to navigation, without giving ample notice, are subjects of grave complaints.

That there is no good reason why the light vessels on the coasts of the United States (if properly constructed and moored) should not remain at their moorings under as unfavorable circumstances as those on the coasts of England and Ireland.

That whenever light vessels are reported to have parted their moorings, the circumstances attending them should be carefully investigated by competent and disinterested persons, and the result made known.

That the erection of light-house towers of a uniform height, without regard to the elevation of the land upon which they are placed, is contrary to the first principles of light-house engineering, involving, in situations of great natural elevations above the level of the sea, unnecessary

expense, and on low coasts the inefficiency of the light for want of sufficient range.

That due regard has not been had to the wants of commerce in selecting sites for lights along the coasts of the United States.

That for want of a proper system in this branch of the public service, the densely populated coasts have a superabundance of lights, to the injury of navigation, while on the sparsely settled coasts, bounding the great outlet to the millions of commerce from the valley of the Mississippi and its tributaries for hundreds of miles, there is not a single light.

That light-house construction, illumination, inspection, and superintendence, involve a large amount of special and general professional knowledge of a high character, and therefore should only be entrusted to the most competent professional persons.

That competent engineers have not been employed, except in a few instances, to plan and superintend the construction and fitting up of the light-houses of the United States.

That the large amounts required annually to repair and keep in good order the towers, buildings, vessels, and illuminating apparatus of the lights in the United States, is attributable to the manner in which the work was executed, and to the inferiority of the materials employed.

That large sums are now required to preserve foundations of light-towers, sea-walls, &c., which might have been saved by the adoption, by competent engineers, of proper plans and foundations for them.

That no systematical and economical plan of construction has been employed in the light-house establishment.

That changes are constantly taking place in the aids to navigation, without any official notice being given to the public of them, which are calculated to mislead mariners.

That there is no proper system of beaconage and buoyage, nor any list of them, by which the navigator, who is not familiar with the coast, can derive any benefit.

That the list of light-houses and light-vessels is defective in many respects; and it, at present, affords very little information to the navigator, and is, in some respects, erroneous.

That there is no regular systematic or effective mode of giving notice to mariners of proposed changes in lights, &c., &c., or of any that may have been destroyed or removed by the action of the sea or winds.

That the buoys are not properly painted according to law, nor are they in other respects properly distinguished one from another.

That light-houses and light-vessels are not sufficiently well distinguished by day.

That the buoys are not properly placed, nor replaced when driven from their positions, and without delay.

That buoys are not placed upon new shoals, over wrecks, &c., except by a special act of Congress, through the agency of some philanthropic or interested person.

That spare buoys are essential for all harbors and rivers in sufficient numbers to allow for all casualties, and for cleaning, painting, &c., &c.

That there is no code or manual of instructions to guide light keepers and others connected with the light-house service, in the performance of

their duties in this country, as is found in every well regulated light-house establishment elsewhere.

That there is no meteorological reason for the lights of the United States being worse than those of equal class and importance in England and France.

That there are no proper books of daily expenditure kept; no returns of daily expenditure made of a reliable character; and the lights are deficient in all the essentials for the faithful performance of this duty, such as books, forms, registers, &c., &c.

That light keepers should be required to devote all their time to the care of the lights under their charge, and should not be allowed to attend to their ordinary affairs, to the injury of the service.

That if all our present lights were fitted with lens apparatus of equal power to the reflectors now in use, the annual expense for supplies of oil and cleaning materials would cost little more than one-fourth as much as is now expended for these articles of supply annually; that is, that the supplies now costing upwards of $152,000, would not exceed $38,000 to $42,000, making an annual saving of $110,000 to $115,000.

That in addition to the greater superiority in brilliancy, power, and economy of the lenses, compared to the reflectors, they possess the great advantage of durability, to the extent of never requiring to be renewed.

The Board therefore recommend:

That the general programme for improving the sea-coast lights of the United States, and of making necessary additions, be adopted as the basis of future recommendation and legislation.

That the Fresnel or lens system modified in special cases by the holophotal apparatus of Mr. Thomas Stevenson, be adopted as the illuminating apparatus for the lights of the United States, to embrace all new lights now or hereafter authorized, and all lights requiring to be renovated either by reason of deficient power or of defective apparatus.

To be Continued.

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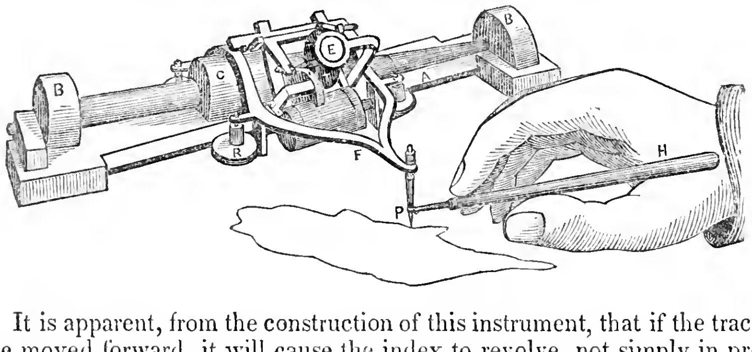
*Description of Sang's Platometer, or Self-Acting Calculator of Surface.**

The usual method of discovering the area of a figure drawn on a plan is, to divide it into a number of triangles or trapeziums—to measure the base and altitude of each, and take the sum of their products. By a careful process of this kind, the area may be discovered with great accuracy; but as it is necessary to revise the calculations several times, both for the purpose of obviating faults in the arithmetical part of the work, and in order, by taking the average of a few independent measurements, to increase the probable accuracy of the result, this method of calculation, especially when the figure is irregular, entails a considerable amount of labor of an irksome kind. Attempts have been made to avoid this by cutting the figure from the sheet of paper, and weighing it in a delicate balance against weights consisting of parts of the same paper, of determinate sizes; but this method, at first sight simple and practical, is rendered of little use by the impossibility of obtaining paper of uniform

* From the Glasgow Practical Mechanic's Journal, December, 1851.

thickness throughout the sheet, the variation of thickness, and hence of weight, being greater than the amount of error that could be allowed in the results.

The instrument invented by Mr. Sang, of Kirkaldy, represented in our perspective figure, indicates the area of any figure, however irregular, on merely carrying the point of a tracer round its boundary, and, besides the advantage of not injuring the drawing, it possesses that of speed and accuracy. A frame, A, carries an axle, which has on it two rollers, B, of equal size, and a cone, C. It is heavy, so that it maintains its parallelism on being pushed along the paper. The sides of the frame are parallel to the edge of the cone, and are fitted to receive the circumference of four friction rollers, R, which move along A, and carry a light frame, F, terminating on the tracing-point, P, to which the handle, H, is attached by a universal joint. The frame, F, also carries a wheel, I, which, by means of a weight, is pressed on the surface of the cone, and receives motion from it as the tracer is carried along the paper. The index-wheel, I, only touches the cone by a narrow edge, the rest of its circumference being of smaller diameter, and containing a silver ring divided into 200 parts, which are again subdivided by a vernier into 2000 parts. The value of each of these divisions is the $\frac{1}{100}$th part of a square inch; so that one turn of the wheel represents 20 inches. Another index-wheel, T, moved by I, is divided into five parts, each of which represents 20 inches, so that a complete revolution of T values 100 inches. The eye-glass, E, assists in reading the divisions and vernier.



It is apparent, from the construction of this instrument, that if the tracer be moved forward, it will cause the index to revolve, not simply in proportion to that motion, but in proportion to the motion of the tracer multiplied by the distance of the edge of the index-wheel from the apex of the cone; and that the revolving motion of the index-wheel will be positive or negative, according as the tracer is carried backwards or forwards. Hence, if the tracer be carried completely round the outline of any figure, on arriving at the end of its journey, the index-wheel will show the algebraic sum of the breadth of the figure at every point, multiplied by the increment of the distance of the points from the apex of the cone; that is to say, the area of the figure.

This instrument possesses great simplicity of construction. Both factors of the continuous multiplication are directly transmitted from the motion of the tracing point in the simplest manner. The influence of the elasticity

of the parts of the machine on the accuracy of its indications, may be discovered by moving the tracer a second time over the boundary of the figure, after having turned the whole instrument round 180°. The effects of the imperfections in the mechanism will now have changed signs, and one of the results will probably be found to be a little too large, and the other a little too small. The average between the two is the exact area of the figure, and is more to be depended on than the results of measurements made by scale and calculation in the usual way. A careful operator, in using the platometer, will always take the average of two tracings in this manner; but when he experiences the rapidity with which this may be done, he will find the trouble as nothing in comparison with the harassing labor of calculating by scale and multiplication.

Rules for Solid Mensuration. By Ellwood Morris, *Civil Engineer.*

The following letter, addressed to a member of the Institute, is published with the consent of the writer. It presents to our readers a very interesting generalization, and it is hoped that Mr. Morris may soon favor us with a theoretical demonstration of his application of the prismoidal rule.

Dear Sir:—In the course of my practice as a Civil Engineer, the frequent occasion I have had for the employment of the ordinary rules of *solid mensuration*, naturally drew my attention to their redundancy as laid down in the books, for the solution of particular cases; and some years ago, in several papers published in the *Journal of the Franklin Institute*, on the application of the "*prismoidal formula*" to the mensuration of excavation and embankment, I pointed out the fact, that this formula is *the fundamental rule for the mensuration of solids;* and that the rules of the books are merely particular cases, in which, by the elimination of certain terms, fewer figures are required.

Reflecting then upon the immense mass of matter necessary to be committed to memory by the modern scholar, it occurred to me, that it would be much better to teach this rule alone in the schools, than to burden the pupils' minds unnecessarily with a host of special rules, which are in fact particular cases of the "*prismoidal formula*," though none of the works on mensuration have ever pointed out their connexion and dependency.

Not having time to develope this matter so fully in scientific language, as to command the attention of the mathematicians of the country, and failing then to enlist the interest of those to whom I mentioned it, I had dismissed the subject from my mind, until recalled to it incidentally by a recent conversation with yourself.

Busied at the present moment in preparations to take the field upon an important professional service, I have only time to call your attention to a number of leading rules of solid mensuration, which are superseded by the "*prismoidal formula;*" a formula in itself so simple, that it may be committed to memory in five minutes' time, by any child of ordinary capability.

The leading rules of solid mensuration laid down in the books, separate rules being given for each solid, are the following, every one of which may be superseded by the "*prismoidal formula.*"

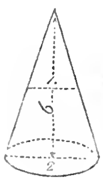
1. To find the solidity of a Cube.
2. " " Parallelopipedon.
3. " " Cylinders and Prisms.
4. " " Cones and Pyramids.
5. " " Frustum of Cone.
6. " " Frustum of Pyramid.
7. " " Wedge.
8. " " Prismoid.
9. " " Sphere.

A number of other special rules are given for the solidity of spheroids, paraboloids, and other solids of revolution, their spindles and segments; to many of which our formula is also applicable; but for the purposes of this communication, it may be sufficient to show, by actual figures, working out examples of the most unpromising cases, the applicability of the "*prismoidal formula*" to compute the solidity of *a cone*, *a wedge*, *a sphere*, and *a hemisphere*. I may here mention, that its accurate application to spheres and spheroids (solids of curved surface) has excited the surprise of many mathematicians, who were prepared to admit its fitness for the mensuration of right lined or plane bounded solids.

By the Special Rules of the Books.

To find the solidity of a Cone.

RULE.—Multiply the area of the base by the height, and one-third of the product will be the solidity.



Given.—A cone having a diameter at the base of 2, and a height of 6. Query: The *solidity?*

$2 \times 2 \times {\cdot}7854 = 3{\cdot}1416$

Mid. diam. $= 1.$ $\qquad 6$

$3)\overline{18{\cdot}8496}$

Solidity $= 6{\cdot}2832$

By Prismoidal Formula.

The Prismoidal Formula is,—Add into one sum the areas of the two ends, and four times the middle section parallel to them; then this sum multiplied by one-sixth of the height will give the solidity.

In the case of the cone opposite, the diameter of the base being 2, and of the mid section 1, we have, by the prismoidal formula,

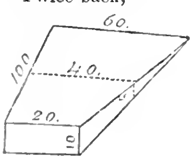
Base,	$2 \times 2 \times {\cdot}7854$	$= 3{\cdot}1416$
4 times mid sec.	$1 \times 1 \times {\cdot}7854 \times 4$	$= 3{\cdot}1416$
Top		$= 0{\cdot}$
	$\frac{6}{6} = \frac{1}{6}$ ht. $= 1{\cdot} \times$	$6{\cdot}2832$
Solidity, . .		$= 6{\cdot}2832$

To find the solidity of a Wedge.

RULE.—To the length of the edge, add twice the length of the back; multiply this sum by the height of the wedge, and then by the breadth of the back: one-sixth of the product will be the solidity.

Given.—A wedge; length of edge 60, back length $= 20$, back breadth $= 10$, height 100. Query: *Solidity?*

Length of edge,	.	$= 60{\cdot}$
Twice back,		$20 \times 2 = 40.$
		100.
		100
		10,000
		10
		6)100,000
		Solidity $= 16{,}666\frac{4}{6}$



Wedge—Solidity by prismoidal formula.

Area of base,	.	$20 \times 10 = 200$
Four times mid sec.		$40 \times 5 \times 4 = 800$
Top,	. .	$= 0$
	$\frac{100}{6} = 16\frac{2}{3} \times$	1000
Solidity,	.	$= 16{,}666\frac{2}{3}$

We will now take the case of a sphere, to which nearly all mathematicians have at first sight denied the applicability of the "*prismoidal formula.*"

By Special Rules.

To find the solidity of a Sphere.

Rule.—Multiply the cube of the diameter by decimal ·5236, the product will be the solidity.

Given.—A sphere of a diameter or axis in length =12. Query: The solidity? Then

$12 \times 12 \times 12 \times \cdot 5236 = 904 \cdot 7808$ solidity.

By Prismoidal Formula.

Solidity of the Sphere opposite.

Top	= 0
Four times mid sec. $12 \times 12 \times \cdot 7854 \times 4$	= 452·3904
Base	= 0
	452·3904
$\frac{1}{6}$ ht. $= \frac{12}{6}$	= 2
Solidity	= 904·7808

Solidity of a Hemisphere.

Take the same dimensions as in the sphere above, and we have—

	2)904·78
Solidity of hemisphere	= 452·39

Solidity of a Hemisphere.

Diameter of mid section	= 10·392
Diameter of base	= 12
Height or radius	= 6

Then by Prismoidal Formula—

Area of base	= 113·097
Four times mid sec. $10 \cdot 392 \times 10 \cdot 392 \times \cdot 7854 \times 4$	= 339·272
Top	= 0
	452·369
$\frac{1}{6}$ ht. $= \frac{6}{1}$	
Solidity	452·369

The difference in the last decimals is owing to too few decimal places having been used in the computation.

For the sake of illustration, it is not necessary to go any further, and I think you will, on examination, admit that the "*prismoidal formula*" possesses some curious and useful properties; and that its adoption in the schools in teaching solid mensuration, would alleviate materially the tasks of the scholar.

Pittsburg, February 7, 1852.

AMERICAN PATENTS.

List of American Patents which issued from February 10th to 24th, 1852, *(inclusive,) with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

15. For an *Improvement in Shoe Brushes;* John Jay Adams, Boston, Massachusetts, February 10.

Claim.—"I therefore claim as my invention, the brush as constructed substantially as represented in figure 2, and as above described; that is to say, with its polishing and blacking bristles arranged essentially as exhibited in the said figure and as above explained."

16. For an *Improvement in Watch-Chain Swivels;* Samuel Y. D. Arrowsmith, City of New York, February 10.

"The nature of my invention consists in the construction of a swivel with the rotating parts concealed, and with but one spring to operate on both ends, which spring passes through the entire centre of the shaft."

Claim.—"What I claim as my invention is, 1st, the making swivels with a central spring to operate at both its ends against the knuckles of the joints, and for closing the opening, substantially as described.

"2d, In combination with the swivel so made, I claim the swivel joint made substantially as described."

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17. For *Hose Coupling;* Albigence W. Cary, Brockport, New York, February 10.

"The nature of my invention consists in providing a spring, clasp, or band, of any suitable material, of such a form, that a part of one or both ends shall extend beyond the place of fastening, the object of such extension being to secure the uninterrupted pressure or contracting force of the clasp around the entire circumference of an inserted tube, and thus form a joint which shall be perfectly water tight under any hydraulic force which the hose shall sustain."

Claim.—"I do not claim as my invention, the clasp in its general form, or as made to spring and used with a screw; I claim the clasp of the particular form above described, having a part of one or both ends extended beyond both places of fastening, so as to extend the contracting pressure directly around the entire circumference of an inserted tube, which extension I claim as a new and useful improvement on all clasps or bands used for coupling hose, with which I am acquainted."

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18. For an *Improvement in Horse Powers;* M. H. Cornell, Feasterville, Pennsylvania, February 10.

Claim.—"Having thus described my improved horse power, what I claim therein as especially new is, the method of regulating the motion by means of a brake worked by a governor constructed substantially as herein described, so as to operate the brake with a force which increases with the velocity of the machine, until the motion is checked, and then instantly release the brake, so that no unnecessary labor may be imposed upon the animals, when working at the proper speed."

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19. For an *Improvement in Mills for Grinding Quartz;* Smith Cram, City of New York, February 10.

"My quartz crusher and grinder consists mainly of a horizontal annular trough, and of two vertical crushing wheels, which are caused to rotate in the trough, and at the same time to revolve around a central axis."

Claim.—"What I claim as my invention is, the crushing and grinding mill herein described, consisting of a trough and one or more rotating wheels, the acting surfaces of both the wheels and trough being formed as herein set forth, so that the former will run in the latter, without tendency to run over its edges, except as it may be influenced by centrifugal force.

"I also claim the combination of a double ridged wheel rim with a trough of corresponding form, whereby the lumps of quartz, or other substance being ground, are grasped by the wheel in its rolling between the angular groove or furrow contained between the two ridges, and being thus prevented from escaping laterally, are crushed upon the ridge of the trough with much less force and greater effect than if the angular action of the ridges was counteracted by the embedding of the lumps to be crushed, among smaller granular and pulverized particles, which is always the case when the concave or inner angle is below, and the convex or outer angle above, which is the converse of the combination to which this claim refers.

"I likewise claim the method of constructing the wheels of a crushing and grinding mill, of removable sections, substantially in the manner and for the purpose herein set forth."

20. For an *Improved Mode of Preventing Collisions on Railroads;* Thomas A. Davies, City of New York, February 10.

"The nature of my invention consists in applying to a locomotive engine, a sound gatherer with an ear piece, in such a manner that any extraordinary noise made by the approach of a train, or by a steam whistle, or any known way of making a great noise, is gathered and communicated to the ear of the engineer, in time to stop his engine, or train, as the case may be."

Claim.—"What I claim as new and original is, the application of a sound gatherer with an ear piece, to a locomotive engine, or train of cars, arranged substantially as above described, so that the engineer or another can ascertain by sound, the approach of a locomotive or train, in time to prevent collision."

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21. For an *Improvement in Grain Harvesters;* Byron Densmore, Sweden, New York, February 10.

"My invention and improvements consist in a new arrangement for raking the grain from the machine; likewise in a new arrangement for raising and lowering the machine, to vary the height of cut; also in a new mode of hanging the sickle."

Claim.—"What I claim as my invention is, 1st, the combination of the grooved cam (M,) and reciprocating lever K^1, so arranged with each other as to give the rake, while in the act of clearing the platform of grain, an increased rapidity of motion, as compared with its backward movement.

"2d, Controlling the motion of the rake by means of the combined action of the hand (I,) ratchet (*i*,) and lever R as set forth.

"3d, The arrangement of the double eccentric (U,) for equalizing the power of the spring (*m*,) on the lever K, in the manner described.

"4th, Forming supports for the vibrating blade, or sickle, by the plates (*f, f, f*,) in sections separate from the fingers, to prevent choking, as described and represented."

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22. For an *Improvement in Shovel Ploughs;* James H. Forman, Sharon, Alabama, February 10.

Claim.—"What I claim is, the use of the fulcrum pin *d*, and adjusting arrangement of the pin e^2, in combination with the beam and stock of a plough, for the purpose of regulating the dip of the ploughshare, substantially as set forth."

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23. For an *Improvement in Railroad Switches;* Amos Hodge, Adams, Massachusetts, February 10.

Claim.—"I claim the system of levers, lock bolt, and springs, arranged substantially as herein described, in such manner that the switches are always locked securely in the proper position for the direct passage of a train along the main track, unless intentionally unlocked and shifted, as described, and when shifted, are automatically returned to their position in the line of the main track, and locked there, as soon as the force by which they were shifted is withdrawn.

"In combination with the above, I claim the system of jointed levers, wedge blocks, sliding bars, dogs, dog lever, and hook ended bar, or their equivalents, acting substantially as herein described, in such manner that the switch is shifted automatically, to permit a train to pass from a branch to the main track, and is maintained in such position, until the last car has passed off it, when it returns automatically, to restore the continuity of the main track."

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24. For an *Improvement in Portable Shower Baths;* Ferdinand Holm, Brooklyn, New York, February 10.

"The nature of my invention consists in the combination of a force pump, with a box of an octagonal or other suitable form, and jointed together at the middle, so as when closed to form a semi-octagonal box, to hold the force pump, jets, etc.; also in combining with the box or bath tub when opened, a series of leaves, to extend the area of the tub by means of slides, holding the edges of the leaves together, in one continuous rim, to prevent the spray from the jets wetting the floor."

Claim.—"What I claim, therefore, is, the use of the box or tub, for a portable shower bath, made in two halves, in combination with the slide C, leaves D, D, &c., and slides G, G, &c., substantially as set forth."

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25. For an *Improvement in Grass Harvesters;* William F. Ketchum, Buffalo, New York, February 10.

Claim.—"Having thus fully described my improvement, what I claim therein as new is, 1st, sustaining the rack piece D, in the manner set forth, by projecting a beam C, from the frame above the grass and behind it, to which it is connected by the rods E, as herein fully set forth; and in combination therewith, I claim the shield plate G, in connexion with the beam C, for sustaining the rack piece D, substantially in the manner and for the purpose above described."

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26. For an *Improvement in Apparatus for Regulating and Measuring the Flow of Gas;* Wm. B. Leonard, City of New York, February 10.

Claim.—"I do not claim the indicating apparatus for showing the quantity of gas or fluid consumed in a given time; nor do I confine myself to the use of any particular mode of indicating it, as it may be performed in various ways; neither do I confine myself to the peculiar form of clock movement or mechanism for giving motion to the disk F; but what I do claim is, 1st, the employment, for the purpose of registering the flow of gases and fluids through an aperture, of a disk F, receiving a constant rotary motion, at an uniform speed, and giving motion to a wheel J, in connexion with the indicating apparatus and the cock B, or its equivalent, in the manner herein described, to wit: the wheel J being moved farther from or nearer to the centre of the disk, as the cock is opened or closed, so as to govern the speed of the wheel, and consequently, the indicators, according to the area of the passage through which the gases or fluids are passing.

"2d, The manner of stopping the clock movement, when the cock or faucet is shut by the arm *q*, on the spindle, *o*, being operated by the wheel J, and the lever *p*, substantially as herein shown.

"3d, The manner of closing the valve D, and shutting off the gas or fluid, when the clock is run down, by an arm S, on a spindle *r*, operated by a spring *t*, and held back by a lever U, stopped by suitables catches, and released by the unwinding of the main spring, substantially in the manner herein specified."

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27. For an *Improvement in Governors;* Ephraim Morris, City of New York, February 10.

Claim.—"What I claim as new is, an incline or inclines between a hub and cylinder on a shaft, in combination with a resisting spring, or its equivalent, whereby the motion of the parts due to the compression of the spring or its equivalent by the inclines, produces motion to regulate the power, in proportion to the resistance, as described."

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28. For *Improvemenis in a Quartz Crusher;* James H. Swett, Boston, Massachusetts, February 10.

"The nature of my invention consists in arranging a metallic cylinder, which may be round or many sided, into which the material to be operated upon is placed, and which has a rotary motion in one direction; and passing through said cylinder, a shaft, carrying any suitable number of curved arms, which have a rotary motion in a direction contrary to that of the cylinder, and which catch up, carry, and throw over a series of metallic balls, by which the material to be ground or crushed is operated upon."

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, in combination with a cylinder containing the quartz, &c., and rotating in one direction, for the purpose of loosening up the material to be ground or crushed, the curved arms arranged upon a shaft therein, rotating in a contrary direction, for the purpose of catching, carrying up, and throwing over the balls by which said material is ground or crushed; the whole being arranged and combined in the manner and for the purpose herein fully set forth."

---

29. For an *Improvement in Seed Planters;* Edward Wicks, Bart, Pennsylvania, February 10.

"My invention consists in so constructing the several distributing wheels, with movable

adjuncts or slides, through which the supply is received by the wheels, as that any lateral motion or play of the carrying shaft will not be attendant with the usual friction, or impeding contact, that the distributing wheels now are subject to upon the sides of the apertures through which the grain is fed."

Claim.—"I do not claim exclusively causing the distributing wheel (constructed with cogs or teeth as described) to enter the body of the hopper, as such has already been done: but what I do claim as my invention is, the employment of a slide D, or its equivalent, through which the distributing wheel works, and that, by being movable, operates to avoid friction of the wheel upon the sides of the aperture, (communicating with the hopper,) as liable to be produced by the play of the shaft upon which the distributing wheel, C, is hung, essentially as herein represented and specified."

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30. For an *Improvement in Processes for Dissolving Gold;* Charles F. Spieker, City of New York, February 10; ante-dated August 10, 1851.

Claim.—"What I claim now as my invention is, the separating of gold from its ores, sands, or mixtures, in suitable apparatus, by the use of free chlorine gas, when absorbed by water alone, or by water in combination with an alkali, or an alkaline, earthy, or metallic chloride, containing an excess of chlorine, as set forth in the specification."

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31. For an *Improvement in Railroad Car Brakes;* Birdsill Holly, Assignor to S. Hewit, E. S. Latham, B. Holly, and A. Downs, Seneca Falls, New York, February 10.

Claim.—"What I claim as my invention is, the fixed and sliding rubbers upon the adjacent axle of a railroad car, in combination with the intermediate cog wheels; the whole arranged and operating substantially as herein set forth."

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32. For an *Improvement in Excavating and Dredging Machines;* Calvin Willey, Jr., Chicago, Assignor to C. Willey, Jr., and Urial Walker, Babcock's Grove, Illinois, February 10.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, 1st, so arranging the frame upon which the endless chains carrying the ploughs and buckets are supported and carried, as to allow said ploughs and buckets to work outside of the line of said frame, and thereby to sink to any desired depth, without liability of the frame resting upon the bank to be removed, and limiting the depth to which the cutters may sink, as herein described.

"2d, I claim so connecting the machinery for raising and lowering the frames carrying the ploughs and buckets, with the driving power of the machine, that the buckets may be lowered automatically, in such proportion to the motions of the other parts of the machine, as the character of the bottom to be excavated may demand, in manner and for the purpose substantially as described."

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33. For an *Improvement in the Construction of Grate Bars for Furnaces;* Francis Armstrong, New Orleans, Louisiana, February 17; ante-dated August 17, 1851.

Claim.—"What I claim as new and of my invention is, the form and construction of the grate bars for furnaces having jogs, *a*, in the blade of the bar, A, extending from the lower line or edge of the bar, up to the level of the lower line, C, of the extension, through the fire front, thereby securing the advantage of having said grate bars held permanently in their required position, by the said jogs touching each other, and at the same time leaving all that section of the openings above the jogs, free for the admission of a poker between the bars, to remove any solid matter produced from the combustion of the fuel."

---

34. For an *Improvement in Pumps;* Abel Barker, Honesdale, Pennsylvania, February 17.

Claim.—"What I claim as my invention is, the combination and arrangement of the two barrels, A and B, and the pistons, E and F, in such a manner that the water shall flow down through the lower barrel, and up through the upper barrel, thereby enabling

one piston to act in descending, and the other in ascending, for the purpose of producing a constant flow of water, substantially in the manner herein described.

"I also claim the peculiar construction of the lower piston, F, by which its valve allows the water to pass downward, and closes by its own weight, either with or without magnetizing, substantially in the manner and for the purpose herein decsribed."

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35. For an *Improvement in Explosive Compositions for Blasting Rocks;* Edward Callow, London, England, February 17; patented in England, August 6, 1850.

Claim.—"What I claim as my invention is, the explosive compound herein described; but I would have it understood, that some of the materials mentioned as component parts in my improved explosive compound, have been used before by pyrotechnists and others, in the manufacture of various fire-works; and that as regards such use, I do not claim any thing in my invention, except so far as regards the combination I have given, and for the purposes also mentioned.

"The shape and material of the cartridge cases have nothing to do with my invention, they being optional with the party using them. I have only given drawings of, and described what I have found to be the most convenient for the purpose."

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36. For an *Improvement in Fences;* John Card, Gainesville, New York, February 17.

Claim.—"What I claim as my invention is, the construction of the posts in pairs, and their combination with the rails, in such a manner as to render the fence strong and firm, by balancing the weight of the fence, by its construction as herein above described, upon each side equally of the centre of each pair of posts, and securing at the same time the advantages of a straight fence, and of posts standing upon the surface, and secured from decay.

"I do not claim as my invention the construction of the posts as herein above described, either singly or in pairs; but the combination of the advantages above mentioned, as substantially described in this specification, and as above claimed by me."

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37. For *Improvements in Railroad Gates;* Egbert P. Carter, Yorkshire, New York, February 17.

"The nature of my invention consists in so constructing rail gates, to be opened and held open by the action of the cars in passing, as that the gate shall swing upward in the arc of a circle, from an axis in the centre of the hub of the gate, by means of a shaft, which the passing train first rotates and then holds fixed, thus avoiding the necessity of having any portion of the apparatus to sink below the level of the track, which is liable to become inoperative by snow, ice, &c."

Claim.—"Having thus fully described my invention, what I claim therein as new is, the method herein described for balancing a railroad or other gate, viz: by means of a spring, coiled around a stationary axis, to which it is attached by one end, the other end being attached to the disk which forms the hub or centre of the gate turning on said axis, substantially as herein described.

"I also claim the use of the rock shaft, provided with the cam ledges and straight ledge, to be operated upon by the wheels of the passing train, and the cams for winding up the chains which draw up the gates; the whole being arranged in the manner and for the purpose herein substantially set forth and shown."

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38. For *Improvements in Machinery for Making Chains;* John M. Crawford, New Castle, Pennsylvania, February 17.

"The nature of my improvement consists in a certain new and useful combination and arrangement of mechanical devices, which operate successively upon the wire or rod, (previously heated to a welding heat,) cutting a piece therefrom of the proper length to form the link, bending the same to a semi-oval or U shape, lapping the ends and welding them together; and thus form the link, and deliver it upon a vibrating suspending arm, on which it is turned, and carried to a seat, from which (seat) it is displaced by the formation of the succeeding link; there being required during the operation of the machine, but one attendant to feed the wire or rod in the machine."

Claim.—"Having thus described the construction and operation of my machine for

making chain, I wish it to be understood, that I do not claim to be the original inventor of "the combination of the parts, movements, and operations, in one machine, which are required to make jack chains by one process from straight wire, after it is cut off in suitable lengths, to the finished chain;" nor do I claim "the stud pin with a recess in it, as a mandrel, around which the bow of a link is bent, while the bow of another link is held in the recess, thereby forming a continuous chain;" nor do I claim a partly revolving mandrel, with a stud pin and nipper, and other appendages, for bending the last bow of each link, as combined, used, and constituting part of a machine" already patented.

"But what I do claim as new and of my own invention is, 1st, The combination of the welding dies, R R^1, with the swage N, for welding or uniting the lapped ends of the link, and dropping the latter upon the suspending arm, S^1, the advance of the die, R, moving the link to the face of the swage, where the operation of welding is performed.

"2d, Attaching the vibrating arm, S^1, to the bed, w^2, of the die, R^1, and operating the same in such manner as to receive the finished link, and suspend the same in a position to be seated.

"3d, The combination of the slide bar, V, turning lever, W, and cross bar, g^2, constructed and arranged as described and represented; the said bar, V, and lever, W, operating to turn and push the finished link into its seat.

"4th, The link seat, O, attached to the lever, *j*, beneath the swage, N, for receiving the finished link from the suspending arm, S^1, and holding the same until the wire or rod for the succeeding link is fed into the finished link, cut off, bent, and ready to be welded.

"5th, The employment of the curved holding lever, Z, attached to the lever, *j*, in combination with the pendant cam bars, 4 and 5, short pendant arm, 9, arm, Y, pin, 3, and spring bar, X, constructed, arranged, and operating as described: whereby the finished link is held in its seat and liberated therefrom simultaneously with the advance of the die, R, to finish the succeeding link.

"6th, The combination of the spring bar, X, with the shear cutter, L, whereby the pendant cam bars, 4 and 5, are attached, through the pin, 3, and springs, 8 8, to hold or relieve the arm, Z, from the seated link, as described and shown in the drawings.

"Finally, I claim making the grooves, b b^1, in the bed dies, J J^1, slightly oblique to their faces, for the purpose of canting the ends of the rod or wire, so as to allow them to lap, when bent by the levers, P P, as described."

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39. For an *Improvement in Bran Dusters;* Lewis Fagin, Cincinnati, Ohio, February 17.

Claim.—"Having thus fully, clearly, and exactly described the nature, construction, and operation of my improvements in the flour bolting and bran dusting machine, what I claim therein as new are, 1st, The arrangement of the vanes in the blast cylinder, substantially as described in the specification and illustrated by the diagram, fig. 6, whereby I attain a free escape for the blast, and effectually prevent the accumulation of flour within the blast cylinder, and thus keep the cylinder truly balanced on its shaft or axis.

"2d, The insertion of vertical rows of beaters on each rib of the bolting cylinder, and on the vanes (No. 2) of the blast cylinder, from top to bottom, for the purpose of beating the offal at each successive rib and vane, and preparatory to each jet of blast, substantially as described."

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40. For an *Improvement in Bran Dusters;* Abel Hildreth, Newark, Ohio, February 17.

Claim.—"What I claim as my invention is, the arrangement and combination of the several parts of a bolt or bran duster, in such manner that the draft generated by the rotation of the beaters within the bolting screen shall act as a conveyor or elevator, for the purpose of transferring the bran or meal from any portion of the mill to the bolting or dusting apparatus, and shall at the same time cool the bran or meal thus conveyed.

"I also claim the scouring apparatus herein described, consisting of a series of pairs of toothed disks, arranged in vertical order above each other, at such distances apart as will admit of the free passage of the meal or bran between them, alternately from the centre to the periphery between the disks of each pair, and from the periphery to the centre between the pairs of disks.

"I likewise claim the method herein described, of shielding the current of mixed air and meal or bran from the centrifugal action of the revolving disks, by means of stationary diaphragms, arranged as herein set forth."

41. For *Improvements in Stop Motions of Looms;* Lora B. Hoit, Millbury, Massachusetts, February 17.

"The nature of my invention consists in providing a spring, which is acted upon by the lathe, or a screw in it, to traverse a slide, and cause the belt that propels the loom to be thrown upon the loose pulley, and stop the loom when the weft breaks or runs out; thereby dispensing with the lever, cam, and stud upon which the lever vibrated; and in applying a spring or its equivalent, to act upon the prongs of the lever, which has a catch upon it, so as to raise said catch when the shuttle is in the box at the opposite end of the lathe."

Claim.—"What I claim as my invention is, 1st, The forked lever, *g*, and spring, *m*, constructed and arranged substantially as herein described, in combination with the grid, (or pins, *i i i*,) and slide, *b*, to release the slide when the weft is properly drawn across the grid; and to traverse it, to stop the loom when the shuttle ceases to draw the weft across said grid.

"2d, Is the spring, *q*, or its equivalent, to stop the prongs of the lever, *g*, and raise the catch, *n*, so as not to stop the loom when the shuttle is in the box at the opposite end; the parts being arranged substantially as herein described."

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42. For a *Meter for Steam Boilers;* William H. Lindsay, City of New York, February 17.

Claim.—"I do not claim the special use of a plunger, piston, or pistons, poppet valves, or well known cocks, the same being long known and used: but what I do claim as my invention, as constituting a new and useful improvement in the construction and operation of a fluid meter, is, the means herein set forth, for maintaining the feed to the boiler, &c., and the closing or cutting off the communication to and from the meter, in case of accident, or from other causes, arranged and operating for the purpose and with the intent substantially as described."

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43. For an *Improvement in Steam Boilers;* James Millholland, Reading, Pennsylvania, February 17.

"The object of my invention is to protect the fire-box from over heating, and at the same time to insure the most thorough aud complete combustion of the coal burnt therein."

Claim.—"Having thus described my improvements in locomotive's boilers, what I claim therein as new is, the contracted grate in the fire-box, in combination with a supplementary chamber of combustion, supplied with air, and situated at a point intermediate between the fire-box and smoke-box, which is connected with the former and the latter by flues, in the manner substantially as herein described."

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44. For an *Improvement in Grain and Grass Harvesters;* Robert T. Osgood, Orland, Maine, February 17.

Claim.—"What I claim as my invention is, the manner of placing the toggle joint purchase, fig. 4, (with the transverse acting joint, V,) upon the end of the cutter arm, fig. 3, to act in conjunction with the other machinery, giving it as it were a double purchase, by hanging the sweep so that the arm of the crank will be horizontal or parallel with the toggle joint when straight, and giving the cutters its double motion, by acting above and below this line. When the crank or hand, *o*, is up, the purchase is at the upper end of the sweep; when half way down, it is at the lower end or joint, varying like a circular or screw power."

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45. For an *Improvement in the Feeding Apparatus for a Grain Thresher;* William R. Palmer, Elizabeth City, North Carolina, February 17.

Claim.—"What I claim as my invention is, the method herein described of preventing accidents to the feeder of a threshing machine, by interposing between him and the cylinder a roller, or the equivalent thereof, which is arranged across the throat of the machine, and is supported and guided substantially in the manner and for the purposes herein set forth."

46. For an *Improvement in Banding Pullies;* Robert W. Parker, Roxbury, Massachusetts, February 17.

"The nature of my invention consists in driving circular saws or other machinery by a peculiar arrangement of a belt and pullies, by which the main driving pulley is made to pinch the band at the points in the intermediate pullies with any desired force; much of the friction attendant upon the ordinary mode of driving saws and other machinery is dispensed with, the arrangement is more economical, and it is more simple, and a greater effect with the same expedition of the power is obtained."

Claim.—"Having thus described the nature and operation of my invention, what I claim as new is, arranging the driving pulley, B, in reference to pullies, E and F, that the band passing over these pullies is not only pressed, with any desired force, against the periphery of the driver, B, but is also pinched between the pullies, B E, and B F, they operating upon the band as feed rollers, substantially in the manner herein described."

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47. For *Improvements in Capstans;* Peter Roberts, City of New York, February 17.

"The nature of my invention consists of a new combination of mechanical elements, arranged within the base of a machine, known by the following names, viz: capstan, windlass, or heaver, as commonly used on shipboard; the object of which arrangement is the continuous winding motion of that part called the head, (upon which the rope or chain is wound,) while the levers or heavers are caused to move alternately backwards and forwards."

Claim.—"What I claim as my invention is, the combination of the following mechanical elements, viz: the vibrating tumblers acted upon by handspikes; the slide, D, with its racks; the cog wheels, P and Q, the former formed also with ratchet teeth; the ratchet wheel, G, and its hollow shaft; the pawls, M and N; the whole arranged within the base, B, and with respect to each other, and acting substantially as described."

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48. For an *Improvement in Rotary Cultivators;* Pleasant E. Royse, New Albany, Indiana, February 17.

"The chief point of my invention consists in a peculiar construction of the chisel bevel cogs on the driving wheels, for taking and maintaining a firm hold of the ground, the character of which will be apparent."

Claim.—"I am aware that most of the parts contained in this description of my improved machine are not in themselves, separately considered, novel; but that they have, singly or more or less connectively, in similar machines, or others for a different purpose, been employed, patented, or used; such as the front running wheel, D, in ploughs and cultivators driving wheels, A A, having spurs, in various locomotive machines, chain belts and wheels, for communicating motion, revolving shares in harrowing machines; also, in harvesting and other machines, the curved slots and specified appliances, for raising and lowering the shaft, without affecting the stretch of the belt or belts.

"I therefore do not claim as new any of these parts, separately considered, or irrespective of the manner or form, in which I propose in combination to apply them for the purposes and to produce the advantages specified.

"But what I do claim as my invention is, the construction of the teeth on the main or driving wheels of a chisel-formed bevel; that is to say, one face being a continuation of the line or plane of the radius of said wheel, while the other face is beveled, to meet it at an angle somewhat less than forty-five degrees, for the purpose of striking into and taking a firm hold of the ground, in the manner and for the purpose set forth."

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49. For an *Improvement in Weighing Machines;* William and Thomas Schnebly, City of New York, February 17.

Claim.—"What we claim as our invention is, the employment of the method or methods of securing the lever or levers connected with the platform by means of a stop or brake, to hold the platform substantially as described, when this is combined with the pendulous scale or balance, and the apparatus for registering the extent of motion of the said pendulous scale or balance, substantially as specified; by means of which combination we are enabled to register accurately the weight of bodies that roll or slide, or are thrown on

to the platform, and prevent the apparatus from registering, in addition to the actual weight, the momentum of the descending weight of the body to be weighed.

"And we also claim the employment of the mechanism which registers the number of weighings, substantially as specified, when this is combined with the pendulous balance or its equivalent, and its register for registering the sum of the weights weighed by the pendulous balance, substantially as described, whereby an accurate register is kept, not only of the number of articles which have been weighed, but also of the whole weight of what has been weighed, as it is often important to ascertain not only the sum of the things weighed, but also the number of articles which make up that sum."

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50. For an *Improvement in Spoons for Administering Medicines;* J. C. Taylor, West Liberty, Ohio, February 17.

Claim.—"What I claim as my invention is, the particular construction of my spoon with a sliding bottom, and a piston slide, exactly fitting the cavity of the spoon, and the sliding rod, so arranged that it may be slid in at the same moment that the slide tongue or bottom is drawn out, thereby quickly emptying the spoon of its contents.

"I do not claim that my spoon should be a graduating or measuring spoon, but merely for administering medicines already graduated by a physician.

"I claim also, that my spoon will secure, from its arrangement, the advantage of preserving the teeth, and administering all the medicines graduated by the physician, a difficulty often experienced in treating children."

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51. For *Improvements in Knitting Machines;* Timothy Bailey, Ballston Spa, New York, February 24.

Claim.—"What I claim as my invention is, 1st, Releasing the hanging plates, *k*, from the lever, Q^1, by the inclined projections, 5, as they are drawn up, so as to let the uprights, *m*, and lever, U, raise the locking bar.

"2d, The combination of the catch, *n*, (fastened to the upright, *m*,) spring, V^2, lever, U, operated by the groove, E, in the curve, to raise the locking bar, so as to allow the slur to operate and depress the sinkers, to divide the loops and form the stitches; and to raise the lever, Q^1, so as to be caught by the lip, 4, upon the plate, *k*, to lock down the locking bar."

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52. For an *Improvement in Cast Iron Car Wheels;* Albert G. Bristol and Joel C. Jackson, Rochester, New York, February 24.

Claim.—"What we claim as our invention is, the making of car wheels with double plates, extending from the hub to the tread; the plate forming the face of the wheel to be slightly curved backwards, so that a section of it through the centre shall present a very flat arch, whose extremities abut against the rim of the wheel; the back plate, as it spreads from the hub, to be curved in the same direction as the front plate, but as it approaches the tread to be gradually depressed at equal intervals, till it meets the front plate; to be thus thrown into a fold or plait, forming two walls of a triangular cavity, of which the third side is made by the face plate, and in this form to be continued till it meets and unites with the tread; the whole to be in the manner and form substantially as shown in the accompanying drawings."

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53. For a *Duplex Eccentric Valve Motion;* John J. G. Collins, Chester, Pennsylvania, February 24.

Claim.—"What I claim is, the employment of cogs on or to eccentrics wheels, for giving motion to eccentrics or their equivalents, on a second motion, in combination with the guard or framing attached to the clips or straps of the driving eccentric, and so formed and arranged as to unite both vibrating motions derived from the driving and driven eccentrics into one motion, for working the slide and other valves of steam engines, in the manner and for the purpose as specified."

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54. For an *Improvement in Straw Cutters;* Absalom B. Earle, Oneonta, New York, February 24.

Claim.—"What I claim in the foregoing as new is, the method of cutting vegetable substances, by a combined chopping or percussive and shearing cut, produced by means

of stationary knives at the mouths of the feeding troughs, moving knives carried on an oscillating lever and revolving tappets, which actuate the oscillating lever as described."

55. For an *Improvement in Endless Chain Horse Powers;* Horace L. Emery, Albany, New York, February 24.

Claim.—"Having thus fully explained my improvement and its purposes, what I claim as new is, the manner of constructing the converge gears, pinions, and pullies of the endless chain horse power, with their outer sides concave at their centres, sufficiently to receive their fastenings within the plane of the inner side of the arms, spokes, or faces of such of the gears and pullies, which, when confined upon one shaft, and overreach the other shaft, may pass both shaft and fastening freely; the faces of the several couplings or shoulders upon the shafts, as also the ends of the shafts themselves, being in the same planes, and all the fittings and fastenings of the shafts, gears, and pullies agreeing with each other, for the purpose and in the manner substantially as described."

56. For an *Improvement in Vessels for Making Ink;* Alexander Harrison, Philadelphia, Pennsylvania, February 24.

"The nature of my improvement consists in arranging a number of reservoirs or vessels in succession, and so connecting them together, that the fluid from the top of the first shall be discharged into the second vessel near its bottom, the fluid from the top of the second into the third reservoir near its bottom, and so on, thus exposing the entire quantity of ink to the oxygenating action of the atmosphere in each vessel successively, and at the same time draw'ing off from each cask into the successive one, only the purer portions of its contents."

Claim.—"What I claim as my invention is, the arrangement and connecting together a series of vessels for manufacturing ink, in the manner and for the purposes herein set forth."

57. For an *Improvement in the Manufacture of Zinc White;* Samuel T. Jones, City of New York, February 24.

Claim.—"What I claim as my invention is, the use of a porous or fibrous bag, or receiving chamber, with porous sides or bottom, or an air-tight chamber, with a straining or porous bag adapted to the inside thereof, and used in connexion either with a blowing or exhausting apparatus, so that the products of the distillation and oxygenation of zinc, or other volatile metals, may be separated from the accompanying air and gases, which latter will be forced or otherwise drawn through the pores of the cloth bag or chamber, and escape into the atmosphere."

58. For an *Improvement in Saw Mills;* Oliver B. Judd, Rockton, New York, February 24.

Claim.—"I do not claim the common carriage, as shown in the annexed drawings; but what I do claim is, simply and substantially raising the tail block as above described, or in any other way substantially the same."

59. For an *Improvement in Water Wheels;* Joel B. Nott, Guilderland, and William S. Kelly, Princeton, New York, February 24.

Claim.—"We do not claim a water guide, as described in the foregoing specification, composed of a scroll or sections of scrolls, or arcs of circles, or sections of polygons, as concentric with the wheel, to direct the action and impulse of the water upon the concentric wheel, having its guiding surface between parallel planes, as the scroll, and not spiral, as the screw. But what we do claim is, a water wheel composed of a scroll or section of scrolls, or arcs of circles, or sections of polygons, substantially as above described, in combination with a fixed internal guide or guides, made in manner substantially similar to the float or floats of the wheel, but with the direction in reverse, there being sufficient space between the outer extremities of the guide or guides, and the inner extremity of the float or floats, to allow the water to pass between them in all positions; the space between them being substantially on the disk of the wheel, thus causing the driving current of water to

pass between the two, in the direction of the wheel's motion, and act directly upon the inner face of the wheel, propelling the wheel in the same direction with the current; the water being discharged, nevertheless, at the extremity of the scroll, helix, or arcs of circles, or sections of polygons, or either of which the wheel may be composed, in a direction opposite to that in which the wheel revolves."

60. For *Improvements in Cut-Offs;* Frederick E. Sickels, City of New York, February 24.

"In cut-offs as heretofore constructed, in operating the catch by the closing movement alone, the valve cannot be tripped until sufficient motion had taken place to operate the whole extent of the catch, thus occasioning an unavoidable delay in tripping the valve.

"The nature of my invention, therefore, consists in operating the catch or hold, and liberating the valves of trip cut-offs on the movement to close, or return of the valve motion, by means of an adjustable cam or lever, after it has been partially operated upon, on the opening movement of the valve motion, so as to leave as little movement of the catch, to effect the liberation of the valve, as may be desired to be accomplished by the return movement; thereby being enabled to liberate the valve and cut off the steam, as near the first of the return movement as may be desired."

Claim.—"Having thus fully described my invention, what I claim therein as new is, operating the catch or hold, and liberating the valves of cut-offs, on the movement to close, or return motion of the valve, after it has been partially operated upon in opening, substantially in the manner as herein described, so as to leave as little of the catch to be operated, to effect the liberation of the valve, as may be desired to be accomplished on the return movement; thus being enabled to liberate the valve and cut off the steam, as near the first of the return movement as may be desired."

61. For an *Improvement in Apparatus for Boring Hubs for Boxes;* Henry Sidle, Dillsburg, Pennsylvania, February 24.

"The nature of my invention consists in providing an auger and box regulator, for the purpose of boring the hubs and regulating the boxes of wagon, carriage, railway cars, and other vehicle wheels."

Claim.—"What I claim as my invention is, the iron shaft in two parts, with the socket and screw in the centre, marked O, so as to increase or diminish the length of said shaft, and also to feed the bitts as described, whereby a hub may be clamped, bored at both ends for the boxes, and removed from the machine, without removing the cutters from the shaft, replacing them, or changing ends of the hub or shaft."

62. For an *Improvement in Water Gun for Extinguishing Fire;* Hiram Strait, Covington, Kentucky, February 24.

Claim.—"What I claim as of my own invention in the fire gun are, 1st, The combination of the flanch, cap, and guard, constructed and operating in a manner substantially as described.

"2d, Constructing the barrel of the fire gun of successive layers of sheet metal, and casting the breech, trunnion ring, and flanch thereto, in manner substantially as described."

63. For an *Improvement in Grain Winnowers and Weighers;* Thomas T. Strode Coatesville, Pennsylvania, February 24.

Claim.—"Having thus described my improvement in the combined weighing and winnowing machine, what I claim therein as new is, combining a balance lever weigher with the lower portion of the winnowing machine, whereby the grain, when cleaned, is weighed and removed therefrom, by a portable receiver, as described and represented.

"I also claim constructing the balance lever weigher as represented, and mounting the same upon pivots, or knife-edge bearings, whereby its rearward projecting ends are made to serve as ways or inclined planes, upon which is mounted a portable receiver, so as to balance the weigher, whilst its frontward ends are graduated and furnished with weights by which the number of bushels weighed at each time may be indicated, as described."

64. For an *Improvement in Grain Dryers;* T. E. Weed, Williamsburgh, New York, February 24.

Claim.—"I claim the centre hollow shaft, B B, for the double purpose, first, for forming the support in the centre, for the steam chambers and pans, as described; and, second, for forming a passage for the steam to pass into each of the chambers, for heating the machine.

"2d, I claim, substantially as described, the arrangement of the air chambers I I, between the steam chambers, and pans, with openings in them, for a thin blade of air to escape in a circle from the centre, at a right angle, or nearly so, with the main shaft, B B, and the pipe extending through the machine, as shown, for supplying the chambers with air, operating substantially in the manner and for the purpose as herein set forth."

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65. For an *Improvement in Floating Docks;* Orrillus T. Williams, Smithland, Kentucky, February 24.

Claim.—"Having thus described my dock, and the various uses to which it is applicable, I will state, that I do not claim forcing air into a vessel immersed or partly immersed in water, for the purpose of rendering it buoyant, or of admitting water, for the purpose of allowing it to sink; but what I do claim as my invention is, so forming a cylindric or prismatic dock, as to perform the operation of elevating a vessel above the surface, by combining the buoyancy obtained by injecting air into the cylinders, with the forced revolution of the cylinders on their axis, while lying on the water, substantially as herein set forth.

"2d, I also claim making the rigid submerged elevator in such a manner as to be actuated by compressed air, only so long as to get rid of the contained water, and to be freed from the interior pressure, while sustaining its load above the surface of the water, whereby the liability to accident, from the escape of air under high pressure, is avoided, substantially as herein described.

"3d, I also claim, in combination with a flexible tube for conveying injected air, the use of the revolving pipe directly connected therewith, whereby the pipe may be turned as herein described, for varying the direction of the current of injected air, by turning the flexible tube, as herein set forth.

"4th, I also claim, in combination with the flexible tube for the injection of air, the opening in the bottom of the cylinder, and the vents in its top, whereby the dock is rendered buoyant, while wholly immersed in water and freed from interior pressure, on rising to its maximum height on its surface, substantially as herein set forth.

"5th, I also claim the double parbuckle, $c\ c^1$, or analogous turning apparatus, whether a rope or a chain with friction rollers in its links, (fig. 6,) be used for the purpose of turning the opposite elevators ($B\ B^1$) in opposite directions, for the purpose of raising the vessel above the water, in the manner substantially as herein set forth."

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66. For an *Improvement in Apparatus for Lightening Vessels;* Orrillus T. Williams, Smithland, Kentucky, February 24.

Claim.—"What I claim as my invention is, the elevator formed by combining jointed frames of inflexible materials, with flexible enclosures made air-tight above and open below, when said jointed frames are so constructed as to attach themselves to the bottom of a vessel, after being let down by its side, and the flexible enclosure so arranged as to admit of the injection and retention of air beneath it, for the purpose of buoying up the vessel, substantially as herein set forth.

"2d, I also claim making jointed elevator frames, in such a manner as to adjust themselves to the form of a vessel's sides, whereby the flexible enclosure for air is allowed to come in close contact with the outside of the vessel, in the manner and for the purposes herein set forth.

"3d. I also claim, in combination with a flexible enclosure for retaining the air, the hook, D, upright or chain, C, brace, B, and stretcher, S, whereby the elevator is made capable of attaching itself to the vessel, and of raising the same without the necessity of passing a support beneath the keel, as herein set forth."

Designs for February, 1852.

1. For a *Design for a Mantel Grate Frame and Summer Piece;* James L. Jackson, City of New York, February 3.

Claim.—"Having thus fully described the nature of my design, what I claim therein as

new is, the combination and arrangement of the figures, flowers, and ornaments herein represented, the whole forming an ornamental design for a mantel grate frame and summer piece."

2. For a *Design for a Grate Frame and Summer Piece;* James L. Jackson, City of New York, February 3.

Claim.—"Having thus fully described the nature of my design, what I claim therein as new is, the combination and arrangement of the ornamental figures herein represented, and forming an ornamental design for a grate frame and summer piece."

3. For a *Design for Grate Frames;* James L. Jackson, City of New York, February 3.

Claim.—"Having thus described the nature of my design, what I claim therein as new is, the combination and arrangement of ornamental figures herein represented, and forming an ornamental design for a grate frame."

4. For a *Design for Grate Frames;* James L. Jackson, City of New York, February 3.

Claim.—"Having thus described the nature of my design, what I claim therein as new is, the combination and arrangement of the ornamental figures herein represented, and forming an ornamental design for a grate frame."

5. For a *Design for Hair Combs;* James Shields, Fishkill, New York, February 3.

Claim.—"What I claim to be new and original is, the design and configuration of a ladies' hair comb, as described above, and represented in figs. 1 and 2."

6. For a *Design for Stoves;* Conrad Harris and Paul W. Zoiner, Cincinnati, Ohio, February 10.

Claim.—"What we claim as our invention is, the combination of the scrolls and foliage, arranged as set forth in the annexed drawings, so as to form an ornamental design for coal and wood parlor stoves, to be known and called the Juno Parlor."

7. For a *Design for Ladies' Hair Combs;* James Blackman and Charles Skidmore, Newtown, Connecticut, February 17.

Claim.—"What I claim as new is, the design, A, composed or formed of a series of ringlets or curls, *a*, said ringlets or curls forming a curve, and placed on the upper part of the back of the comb; the ringlets or curls being in an inclined position, those on one side of the centre of the comb inclining in direction reverse from those on the other side, substantially as herein shown and described."

8. For a *Design for a Grate Frame and Summer Piece;* James L. Jackson, City of New York, February 17.

Claim.—"Having thus described the nature of my design, what I claim therein as new is, the combination and arrangement of the ornamental figures herein represented, and forming an ornamental design for a grate frame and summer piece."

9. For a *Design for Stoves;* James Leffel, Springfield, Ohio, February 24.

Claim.—"Having thus described and represented my design for stoves, what I claim therein as new is, the combination of the above ornaments, arranged as described."

10. For a *Design for Parlor Stoves;* N. S. Vedder and William L. Sanderson, Troy, Assignors to Warren, Swetland & Little, Half Moon Village, New York.

Claim.—"Having thus described our design of stove, what we claim is, the design and configuration of stove, substantially the same as described and represented in the annexed drawings."

LAW REPORTS OF PATENT CASES.

Reported for the Journal of the Franklin Institute.

Circuit Court of the United States, Northern District of New York, Ross Winans vs. the Troy and Schenectady Rail Road Company.

Action at Law for the infringement of Ross Winans's patent for the improvement commonly known as the Eight-wheel Railway Car.
Defences—Want of originality of invention.
Invalidity of patent—No infringement.

This was an action for the infringement of a patent granted to Ross Winans, on the 1st of October, 1834, for an improvement in the construction of cars or carriages intended to run on rail roads. The suit was commenced on the 14th of July, 1847, and was tried at the term of the Circuit Court of the United States, holden at Canandaigua, June, 1850, before Judge Conklin and a jury—Messrs. Spencer, Keller and Blatchford for plaintiff, and Messrs. Stevens and Buel for defendant.

The nature of the improvement patented, is thus set out by the specification of the patent.

"The object of my invention," the patentee says, "is, among other things, to make such an adjustment or arrangement of the wheels and axles as shall cause the body of the car or carriage to pursue a more smooth, even, direct and safe course than it does as cars are ordinarily constructed, both over the curved and straight parts of the road, by the before-mentioned desideratum of combining the advantages of the near and distant coupling of the axles and other means to be further hereinafter described." This is the object of the plaintiff's invention as stated by him. He then goes on to describe the means he has invented to effect the object he has specified.

"For this purpose," says he, "I construct two bearing carriages, each with four wheels, which are to sustain the body of the passenger or other car, by placing one of them at or near each end of it in a way to be presently described. The two wheels on either side of the carriages are to be placed very near to each other, the spaces between their flanches need be no greater than is necessary to prevent their contact with each other. These wheels I connect together by means of a very strong spring—say double the usual strength employed for ordinary cars—the ends of which spring are bolted, or otherwise secured to the upper sides of the boxes, which rest on the journals of the axles; the larger leaves of the springs being placed downwards and surmounted by the shorter leaves. Having thus connected two pairs of wheels together, I unite them into a four wheel bearing carriage, by means of their axles and a bolster of the proper length, extending across, between two pairs of wheels, from the centre of one spring to that of the other, and securely fastened to the tops of them. This bolster must be of sufficient strength to bear a load upon its centre of four or five tons. Upon this first bolster I place another of equal strength, and connect the two together by a

centre pin or bolt passing down through them, and thus allowing them to swivel or turn upon each other, in the manner of the front bolsters of a common road wagon. I prefer making these bolsters of wrought or cast iron; wood, however, may be used. I prepare each of the bearing carriages in precisely the same way. The body of the passenger or other car, I make of double the ordinary length of those which run on four wheels, and capable of carrying double their load. This body I place so as to rest its whole weight upon the two upper bolsters of the two before mentioned bearing carriages or running gear. I sometimes place these bolsters so far within the ends of the body of the car, as to bring all the wheels under it; and in this case, less strength is necessary in the car body, than when the bolster is situated at its extreme ends. In some cases, however, I place the bolster so far without the body of the car, at either end, as to allow the latter to hang down between the two sets of wheels or bearing carriages, and to run, if desired, within a foot of the rails."

He then goes on to speak of some particular features of this invention, and finally he states explicitly, in a summary at the end of the specification, what he claims, and what he does not claim, as follows:—"I do not claim, as my invention, the running of cars or carriages, upon eight wheels, this having been previously done; not, however, in the manner or for the purposes herein described, but merely with a view of distributing the weight carried, more evenly upon a rail or other road, and for objects distinct in character from those which I have had in view, as herein before set forth. Nor have the wheels, when thus increased in number, been so arranged and connected with each other either by design or accident, as to accomplish this purpose. What I claim, therefore, as my invention, and for which I ask a Patent, is the before described manner of arranging and connecting the eight wheels, which constitute the two bearing carriages with a rail road car, so as to accomplish the end proposed by the means set forth, or by others which are analogous and dependent upon the same principles."

The defendant denied that Ross Winans was the original inventor of the improvement thus described and claimed. He contended that the description given of the invention, was not sufficiently full and clear to enable others to use it—that he had abandoned his invention before obtaining a patent; and lastly, that the defendant's cars were no infringement of the patent. The defendant introduced the testimony of a number of witnesses in support of these positions, and the plaintiff introduced a number of witnesses to rebut this testimony. Judge Conkling reviewed all the points raised, in an elaborate charge to the jury.

After concluding his charge, his Honor, Judge Conkling, in answer to several prayers for instructions, offered by the defendant's counsel, instructed the jury in substance as follows:

That it was undoubtedly true that a patent could not be taken merely for a purpose, end or object, but that he doubted the pertinency of any instruction on that point in this case; because the patent here was not for a purpose, but for the means of effecting a purpose.

That the specification was sufficient, if the patentee had described a carriage susceptible of an attachment of the power to the body, and if

the drawing showed such mode of attachment, and that the plaintiff suffered no disadvantage from not stating it in his written specification, and although the drawing was not to be taken into consideration for the purpose of measuring the extent of the claim, yet it might be considered in ascertaining whether what he claimed was new.

That the patent was valid, if the plaintiff's car was substantially, on the whole, a new and useful thing.

That if a thing, substantially like the plaintiff's car had been described, prior to his invention, in some public work that had been produced, then the patent was not good; but that it was not enough that the description should merely suggest the idea of the invention.

That it was a question of fact for the jury, whether the specification was sufficiently exact and intelligible, in reference to the position of the trucks.

That, in order to find for the plaintiff, the jury must be convinced that what the plaintiff had patented is useful; but that any degree of utility was sufficient to support a patent—the word useful, in the patent law, being used in opposition to frivolous or noxious; and that, with regard to the question of side-bearings, although the jury should think it better to have longer bearings than the plaintiff contemplated, that could not take away the utility of his invention, as it was not necessary that the thing patented should be the best possible thing of the kind that could be made.

That if the jury believe that the intermediate time between putting the Columbus into use, and the taking out of his patent, was devoted, by the plaintiff, in good faith, to perfecting of his invention, he cannot be considered as having abandoned it; but that if the invention was perfected in the Columbus, there could be no need of farther experiment.

That, in order to warrant the jury in finding an infringement by the defendants, they must be shown to have used either the same thing, or substantially the same thing, as the plaintiff's invention.

The jury found a verdict in favor of the plaintiff, on both the questions of originality and of infringement.

A motion for a new trial was argued before Judges Nelson and Conkling, at the June term, 1851, of the court, when Judge Nelson delivered the following opinion denying the motion for a new trial:

NELSON, J., I. I have examined the various grounds presented by the counsel for the defendants, on the motion for a new trial, and after the fullest consideration, am of opinion the motion must be denied.

Most of the exceptions taken at the trial, and relied on in the argument here, are founded upon what we regard as an entire misapprehension of the thing claimed to have been discovered by the plaintiff, and for which the patent has been issued. This will be seen on a reference to the instructions prayed for by the defendants, upon which most of the questions in the case arise. They assume that if any material part of the arrangement and combination in the construction of the cars or carriages described in the patent was before known, or in public use, it is invalid; and hence various parts were pointed out by the counsel at the trial, and the court requested to charge that if either of them was not new, the jury should find a verdict for the defendants.

Now, the answer to all this class of exceptions is, that the patentee sets up no claim to the discovery of the separate parts of the arrangement which enter into the construction of his cars. These may be old and well known, when taken separately and detached, for aught that concerns his invention. His claim is for the car itself, constructed and arranged as described in his patent. This, I think, is the clear meaning of the specification, and of the claim as pointed out in it; proving, therefore, that parts of the arrangement and construction were before known, amounted to nothing. The question was whether or not cars or carriages for running on rail roads, as a whole, substantially like the one described in the patent, had been before known or in public use, not whether certain parts were or were not substantially similar.

The argument presupposes that the claim is for the discovery of a new combination and arrangement of certain instruments and materials, by means of which a car is constructed of a given utility; and that if any one or more of the supposed combinations turns out to be old, the patent is invalid. This is the principle upon which much of the defence has been placed; but no such claim is found in the patent; no particular combination or arrangement is pointed out as new, or claimed as such. The novelty of the discovery is placed upon no such ground; on the contrary, the result of the entire arrangement and adjustment of the several parts described, namely, the rail road car, complete and fit for use, is the thing pointed out and claimed as new. This is the view taken by the Chief Justice of the patent, in the case of the present plaintiff, against the "Newcastle and French Town Turnpike and Rail Road Company," tried before him in the Maryland Circuit, and which was adopted by the judge in the trial of this case.

II. It was further insisted on the part of the defendants, that if the relative position of the two bearing carriages to each other, constitutes a material part of the arrangement in the construction of the cars, the patent was void, unless the jury should find that the specification described with sufficient precision the location of these bearing carriages under the body of the car, so as to enable a mechanic of skill in the construction of cars, to place them at the proper distance apart without experiment or invention. It was also contended that the remoteness of the bearing carriages from each other, was not so described in the specification, as to constitute any part of the improvement.

In respect to this branch of the case, the court charged that the relative position of the bearing carriages to each other, in the construction of the car, was a material part of the arrangement of the patentee, and left the question to the jury whether or not he had sufficiently described the position of the trucks, having in view their distance apart, and also from the ends of the car body, suggesting at the same time, that the location must always depend, in a measure, upon the length of the body.

It will be seen on looking into the specification, that the location of the trucks relatively to each other under the body, as well as the near proximity of the two axles of the truck to each other, form a most essential part of the arrangement of the patentee in the construction of his cars.

Great pains have been taken to point out the defects in the existing

four wheel cars; and the impediments to be encountered and overcome in the running of cars upon rail roads, as the latter are usually constructed. The patentee states that in the construction of them, especially when of considerable length, it has been found necessary to admit of lateral curvatures, the radius of which is sometimes but a few hundred feet, and that it becomes important, therefore, to so construct the cars as to enable them to overcome the difficulties presented by these curvatures, and to adapt them for running with the least friction practicable on all parts of the road. The friction referred to, is that which arises between the flanches of the wheel and the rail, causing great loss of power, destruction of the wheels and rails, besides other injuries. For this purpose, he constructs two bearing carriages, each with four wheels, which are to sustain the body of the passenger or other car, by placing one of them at or near each end of it, as particularly described. The two wheels on either side of the truck, are to be placed very near each other—the spaces between the flanches need be no greater than is necessary to prevent their contact with each other. The car body rests upon bolsters supported on each of the two bearing carriages, or four wheel trucks, the bolsters so constructed as to swivel or turn on each other, like the two front bolsters of a common wagon. The body of the car may be made of double the length of the four-wheeled car, and is capable of carrying double its load. The truck may be so placed within the ends of the car as to bring all the wheels under it, or without the end, so as to allow the body to be suspended between the two bearing carriages. The patentee further states that the closeness of the fore and hind wheels of each bearing carriage, taken in connexion with the use of the two bearing carriages, arranged as distant from each other as can conveniently be done for the support of the car body, with a view to the objects and on the principles before set forth, is considered by him as an important feature of the invention; for by the contiguity of the fore and hind wheels of each bearing carriage, while the two bearing carriages may be at any desirable distance apart, the lateral friction from the rubbing of the flanches against the rails is most effectually avoided, while at the same time all the advantages attendant upon placing the axles of a four-wheeled car far apart are obtained.

The two wheels on either side of the bearing carriages may, from their proximity, be considered as acting like a single wheel, and as these two bearing carriages may be placed at any distance from each other, consistent with the required strength of the body of the car, it is apparent that all the advantages are obtained which result from having the two axles of a four-wheeled car at a distance from each other, while its inconveniences are avoided.

Among the principles stated by the patentee to be taken into consideration in the construction of the car is, that the greater the distance between the axles, while the length of the body remains the same, the less the influence of shocks and concussions occurring on the road; and hence the relief from them, when the trucks are placed under the extreme ends of the body, is greater than when placed midway between the centre and the end.

It is apparent from what we have already referred to in the specifica-

tion, and still more manifest on a perusal of the whole of it, that the improvement in this part of the arrangement does not consist in placing the axles of the two trucks at any precise distance apart in the construction of the car, or from each end of the body. The distance used must necessarily depend somewhat upon the length of the car and strength of the materials of which it is built, and hence it was impracticable to specify in feet or inches, the exact distance from the ends of the car body at which it would be best to arrange the trucks. Neither do the advantages of a car constructed and arranged as described, depend upon the trucks being placed at a specified distance from the ends, or so that there may be a specified distance between the axles.

Having in view the defects in the existing cars, and other difficulties to be encountered, some considerable latitude may be allowed in this respect, consistent with the object sought to be attained, to remedy the defects in the existing cars. All the principles for the construction of one, for the purpose of overcoming these difficulties, and remedying these defects, are particularly set forth in the description given by the patentee. We think the specification sufficient, and that the court was right in the opinion expressed on this branch of the case.

Any mechanic of skill could readily arrange the bearing carriages in connexion with the body of the car so as to secure the advantages so minutely and clearly pointed out, and which are shown to attend the practical working of cars constructed in the manner described.

III. The questions of originality and of infringement, were questions of fact, and depending upon the evidence, and were properly submitted to the jury. We think the weight of it decidedly with the verdict.

IV. The patent in this case was originally issued 1st October, 1834. and was recorded anew, 7th of June, 1837, according to the Act of Congress of the 3d of March, 1837, (5 St. at large 191.) No drawings were attached to the original patent, nor was there any reference therein to drawings. On the 25th of September, 1848, the patent was extended for the term of seven years, from the 1st of October, 1848. The plaintiff gave in evidence at the commencement of the trial, a certified copy of the patent and specification, certificate of the extension, drawing with references to the same, and an affidavit of the plaintiff, made November 19, 1838. The drawing was not filed at the time the patent was recorded anew, but was filed on the 19th of November, 1838. The counsel for the defendant objected to the evidence on the grounds, 1st, That it appeared that no drawing was annexed to the original patent, and 2d, That the Act of Congress did not make such a drawing evidence. The court also instructed the jury in summing up the case, that the drawing, a certified copy of which had been given in evidence, was to have the same force and effect as if it had been referred to in the specification, and was to be deemed and taken as part of the specification.

The first section of the Act of 1837, provides that any person interested in a patent issued prior to the 15th of December, 1836, may, without any charge, have the same recorded anew, together with the descriptions, specification of claim and drawings annexed, or belonging to the same; and it is made the duty of the Commissioner to cause the same,

or any authenticated copy of the original record, specification or drawing which he may obtain, to be transcribed and copied into books of record kept for that purpose ; *and whenever a drawing was not originally annexed to the patent, and referred to in the specification, any drawing produced as a delineation of the invention, being verified by oath in such manner as the Commissioner shall require, may be transmitted and placed on file, or copied as aforesaid, together with the certificate of the oath, or such drawings may be made in the office under the direction of the Commissioner in conformity with the specification.*

The second section provides that copies of such records and drawings, certified by the Commissioner, or in his absence, by the chief clerk, shall be prima facie evidence of the particulars of the invention and of the patent granted therefor, in any judicial court of the United States, in all cases where copies of the original record, or specification and drawings, would be evidence without proof of the loss of such originals. This section also provides that no patent issued prior to the aforesaid 15th day of December, 1836, shall, after the first day of June, then next, be received in evidence in any court on behalf of the patentee, unless so recorded anew, and a drawing of the invention, if separate from the patent, verified as aforesaid, and deposited in the patent office. See also section third of the same act.

It is quite clear, upon the above provisions of the act, that the court was right in admitting the drawings in connexion with the patent and specification in evidence. The whole together are made prima facie evidence of the particulars of the invention and of the patent granted therefor.

The weight to be given to the drawings furnished under the act by way of enlarging or explaining the description as given in the specification, is another question. That will depend upon the circumstances of each particular case. As a general rule, they will not be effectual to correct any material defect in the specification, unless it should appear that they correspond with one accompanying the original specification for the patent, otherwise, in case of discrepancy between the drawing and specification, the latter should prevail. Care must be taken to avoid imposition by the use of the newly furnished drawing, and for this purpose the specification will afford the proper correction, unless the plaintiff goes further and shows that it conforms to the one originally filed.

The charge that the drawing in this case was to have the same force and effect as if it had been referred to in the specification, and was to be deemed and taken as part of it, was, perhaps, too strong, as it respects the drawings furnished under the act of 1837. The principle is true as it respects those accompanying the original application for the patent, but can hardly be said to be applicable to the full extent stated in the case of these newly furnished drawings. The principle might open the way to imposition and fraud. Assuming that there is nothing but the oath of the party attesting that the drawing affords a true delineation of the invention, the specification should prevail in case of a material discrepancy. But admitting the instruction in this respect not to be strictly correct, and that too much weight was given to the drawing, we do not see that it would have altered the result. The specification

afforded a suffieient description of the invention, independently of the drawing. Some slight additions that improved the working of the car, were open to some question, whether they were embraced in the specification, but they did not enter into the essence of the invention, or constitute any substantial part of the improvement. Time and experience usually indicate these slight additions and alterations, and they should be regarded as consequential results belonging to the inventor. It requires time and experience, usually, to perfect the machine, and improvements derived therefrom, are justly due to him.

V. As to the prior use of the car Columbus, and others constructed by the patentee before he made application for his patent, we think the instruction of the court correct. The law allows the inventor a reasonable time to perfect his invention by experiments; and these could be made in this instance, only by putting the car in the service of those controlling lines of rail roads. There were repeated failures in the experiments tried, and the cars abandoned before the perfection of the car described in the patent. These experiments and trials sufficiently account for the previous use set up by way of forfeiture of the invention.

Upon the whole, after a careful examination of the case, and of all the points made by the defendants on the argument, many of which have been noticed above, we are satisfied that the verdict is right, and that a new trial should be denied.

The defendant then moved for "writ of error" to the Supreme Court of the United States, on written briefs filed by D. Buel, Jr., and S. Stevens, Esqs., for the Company, and J. A. Spencer, Esq., for the plaintiff, which was decided January 24th, 1852, negatively.

Counsel for the plaintiff then moved the Court at its late session, for an injunction to restrain the defendants from further violating his rights, upon which motion the injunction was granted.

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Notes on the U. S. Steamer Vixen. By Chief Engineer, B. F. ISHERWOOD, *United States Navy.*

The *Vixen* was one of two small war steamers precisely alike, originally built for the Mexican Government by Messrs. Brown and Bell of New York. These steamers, in an unfinished state, were, at the commencement of the late war with Mexico, still in the hands of the builders, from whom they were then purchased by the United States, armed, and employed against their original proprietors. At the termination of the war, one of them (the *Spitfire*) was sold, and the other (the *Vixen*) retained in the Navy.

As first constructed, the engine of the *Vixen* was fitted with a piston valve and an independent slide cut-off; but on the return of the vessel at the conclusion of peace, double puppet valves and a cut-off, invented by Chief Engineer, Wm. Sewell, U. S. Navy, were substituted; also, the depth of hold was increased from $9\frac{1}{2}$ to 12 feet, and the main shaft raised one foot.

The results given in these notes, are from the log of the vessel after the above alterations were made.

Two kinds of boilers have been used in the *Vixen*, viz: the original boiler with double return drop flues, and the Montgomery boiler with vertical tubes containing the water inside the tubes and having the heated gases applied externally; the space containing the heated gases being divided vertically in two compartments by a division plate or diaphragm placed about midway the tubes. The results from both boilers will be given separately.

Dimensions of the Vessel and Machinery.

Hull.

Length on deck,	118 feet.
Beam, „	22 " 6 inches.
Depth of hold,	12 " 0 "
Draft of water, deep load (7 ft. 9 in. forward, 7 ft. 11 in. aft,) mean,	7 " 10 "
Draft of water with all coal out, but all other weights in,	6 " 6 "
Mean draft of water for the time steamed,	7 " 2 "
Immersed amidship section at 7 feet 2 inches draft,	147 square feet.
Square feet of immersed amidship section per cubic foot of space displacement of piston,	3·467 "

Rig.—Two masted fore and aft schooner. Under sail alone, the vessel may be considered unmanageable.

Engine.—One half beam horizontal condensing engine. Lighthall's patent.

Diameter of cylinder,	3 feet.
Stroke of piston,	6 "
Space displacement of piston per stroke,	42·408 cubic feet.

Paddle Wheels.

Diameter from outside to outside of paddles,	18 feet 6 inches.
Length of paddle,	6 " 4 "
Breadth of paddle	2 " 0 "
Dip of paddle at 7 feet 2 inches draft of vessel,	2 " 8 "
Number of paddles in each wheel,	14.
Number of paddles in water in each wheel at 7 feet 2 in. draft,	3.
Area of two paddles,	$25\frac{1}{3}$ square feet.
Proportion of the area of two paddles to immersed amidship section of hull,	1·000 to 5·802
Proportion of the area of all the immersed paddle surface to immersed amidship section of hull,	1·000 to 1·933

Original Boilers.—Two iron double return drop flue boilers, placed one on each side the engine.

Length of each boiler,	16 feet.
Breadth "	5 " 6 inches.
Height, "	8 " 1 "
Cubic contents of circumscribing parallelopipedon of each boiler,	$711\frac{1}{3}$ cubic feet.
Area of the heating surface in the two boilers,	750 square feet.
" grate " "	47 "
Capacity of steam room in boilers,	584 cubic feet.
" " " and steam pipe,	615 "
Cross area of each of the three rows of flues (both boilers),	6·303 sq. feet.
Cross area of the chimney,	6·303 "
Height of chimney above grate,	43 feet 9 inches.
Mean pressure of steam above atmosphere per sq. in. in boilers,	$12\frac{1}{2}$ pounds.
Initial " " " cylinder,	10·3 "
Cutting off at, from commencement of stroke of piston,	$26\frac{1}{3}$ inches.
Double strokes of piston per minute,	14·23
Consumption of Pittsburg bituminous coal per hour, with natural draft,	564 pounds.

PROPORTIONS.

Proportion of heating to grate surface, . .	15·958 to 1·000	
" grate surface to cross area of each of the 3 rows of flues,	7·457	"
" " " chimney,	7·457	"
" heating surface to cross area of each of the 3 rows of flues,	118·991	"
" " " chimney,	118·991	"
" heating surface per cubic foot of space displacement of piston,	17·685 sq. feet.	
" grate " " " "	1·108	"
" heating surface per cubic foot of space displacement of piston, multiplied by number of double strokes (14·23) per minute, .	1·245	"
" grate surface per cubic foot of space displacement of piston, multiplied by number (14·23) of double strokes per minute, . .	0·078	"
Cubic feet of steam room per cubic foot of steam used per stroke of piston, ...	31·527	
Consumption of bituminous Pittsburg coal per square foot of grate surface per hour with natural draft, . .	12	pounds.
Consumption of bituminous Pittsburg coal per square foot of heating surface per hour with natural draft, .	0.752	"
Sea water evaporated by one sq. ft. of heating surface per hour,		
" " one pound of Pittsburg bituminous coal per hour, ...		

These boilers, (Plate II,) under ordinary steaming would furnish steam enough at the above pressure to cut off at half stroke; the piston of course making a proportionally increased number of strokes; the coal is reported as of very inferior quality.

PERFORMANCE WITH THE ORIGINAL BOILERS.

The following results are the mean of 311 hours steaming in the Gulf of Mexico, during the months of February and March, 1851, embracing the usual variety of wind, sea, dip of paddle, and vessel's draft of water. The boilers were six years old, and very foul with incrustation.

Steam pressure in boiler above atmosphere per square inch, $12\frac{1}{2}$ pounds, cutting off at $26\frac{1}{3}$ inches from the commencement of the stroke, giving a mean effective pressure by indicator of 16 pounds per square inch of piston; number of double strokes of piston per minute, 14·23; actual horse power developed by the engine, 86·266.

The speed of the vessel was 6·52 knots of $6082\frac{2}{3}$ feet, or 7·511 statute miles.

The diameter of the circle of the centre of reaction was $17\frac{1}{4}$ feet; the circumference normal to which is 54·19 feet; and

$54{\cdot}19 \times 14{\cdot}23 \times 60 = 46267{\cdot}42$ feet = speed of centre of reaction of paddles per hour.

$6082\frac{2}{3} \times 6{\cdot}52 = 39658{\cdot}99$ feet = speed of vessel per hour.

6608·43 feet = slip of centre of reaction of paddles per hour.

or, 14·28 per cent.

The oblique action of the paddles, calculated as the squares of the series of their angles of incidence on the water, is 11·94 per cent.

Total losses of effect by the paddle wheels, (14·28+11·94) 26·22 per cent.

The evaporation was obtained as follows: The steam being cut off at $26\frac{1}{3}$ inches from the commencement of the stroke, there was filled per stroke, 15·507 cubic feet of the cylinder, to which must be added 4 cubic

feet comprised between the cut-off valve (which was also the steam valve,) and piston, including clearance, nozzles, &c., making 19·507 cubic feet of steam of the total pressure of 25 pounds per square inch; the initial cylinder pressure being 1.7 pounds less than the boiler pressure. There would consequently be furnished per hour, ($19·507 \times 28·46 \times 60$) 33349·168 cubic feet of steam of that pressure; and as the relative volumes of steam of the density due to that pressure and water are as 1044 to 1, there would be evaporated ($33349·168 \div 1044$) 31·943 cubic feet of water. Taking the cubic foot of sea water at 64·3 pounds, there would be evaporated per hour, by one pound of Pittsburg bituminous coal, ($\frac{31·943 \times 64·3}{564}$) 3·642 pounds of sea water; to this must be added the loss by *blowing off* at $\frac{2}{32}$ of Sewell's Salinometer, obtained as follows: the total heat of steam being taken at 1202° F., the temperature of the feed water from the hot well at 100° F., the temperature of the steam and water in the boilers at 241° F., and one-half the water pumped in the boilers being blown out; then, 1202°—100°=1102°, the heat used in evaporating the water; and 241°—100=141°, the heat used in *blowing off;* hence, 1102°+141°=1243°, the total heat used and lost, and 141 is 11·34 per cent. of 1243, leaving the complement of 100 per cent., or (100—11·34) 88·66 as the proportion of the total heat evolved from the fuel applied to the evaporation of the water; and as this 88·66 per cent. evaporated 3·642 pounds, 100 per cent. would evaporate 4·107 pounds. The evaporation then by one pound of Pittsburg bituminous coal per hour, would be 4·107 pounds of sea water.

Increasing the total weight of water evaporated, in like manner, by the same per centage for loss by *blowing off*, and we have the total evaporation of 36.029 cubic feet, or 2316·64 pounds of sea water by 750 square feet of heating surface, being 3·089 pounds of sea water per square foot.

The original boilers having become corroded out, a pair of the Montgomery vertical tubular boilers (Plate III,) were substituted in 1851.

PERFORMANCE WITH THE MONTGOMERY BOILERS.

The following performances of the Montgomery boilers are taken from the *Vixen's* steam log, kept during a passage from Pensacola to Key West, Florida. On this passage both Cumberland bituminous and anthracite coals were used. In both cases, the conditions of wind and sea remained sensibly the same; the wind and swell were moderate, and abeam. The boilers being nearly new, were clean and free from incrustation.

The Cumberland bituminous was used for the first half of the passage, and the anthracite for the last half, with natural draft in both cases.

PERFORMANCE WITH THE CUMBERLAND.

Mean speed of vessel per hour, 6·64 knots; double strokes of piston per minute, 15·675; vacuum in condenser per gauge 26 inches of mercury; steam pressure in boiler per square inch above atmosphere, 14·67 pounds, cut off at 36 inches from commencement of stroke of piston; pounds of coal consumed per hour, 676; sail used half the time.

PERFORMANCE WITH THE ANTHRACITE.

Mean speed of vessel per hour 5·95 knots. Double strokes of piston per minute 14·88; vacuum in condenser per guage 26 in. of mercury. Steam

pressure in boiler per square inch above atmosphere 14·75 pounds; cut off at 36 inches from commencement of stroke of piston. Pounds of coal consumed per hour 713. Sail used one-third the time.

It was extremely difficult to keep steam with anthracite after the first 24 hours; with Cumberland coal, steam was kept more easily, but after three or four days continuous steaming with it, the spaces between the tubes would choke up, and so impair the draft as to render it necessary to stop the engines, draw the fires, cool the boiler, and clean out the tube spaces.

During an attempt made to steam from Pensacola to New Orleans with Pittsburg bituminous coal, the tube spaces choked completely up in 24 hours, so as to wholly destroy the draft, the flame rushing out into the fire room whenever the doors were opened, and the vessel put back to Pensacola, reaching port with difficulty.

With these boilers, there is required about an hour and a quarter to raise steam from sea water of Gulf temperature, say 60° F.

Calculating the evaporation by the Cumberland coal in the same manner as before, there results an evaporation of 5·237 pounds of sea water per pound of coal per hour, and 3·248 pounds of sea water per square foot of heating surface per hour.

Proceeding in the same manner with the anthracite, there results an evaporation of 4·713 pounds of sea water per pound of coal per hour, and 2·729 pounds of sea water per square foot of heating surface per hour.

Montgomery Boilers.—Two of iron, placed one on each side the engine.

Length of each boiler,	13 feet 9 inches.
Breadth "	5 " 6 "
Height "	7 " 9 "
Cubic contents of circumscribing parallelopipedon of each boiler,	586·09 cubic feet.
Area of the grate surface in the two boilers,	53·60 square feet.
" heating " "	1090·00 "
Capacity of steam room in boilers,	390·00 cubic feet.
" " " and steam pipes,	425·00 "
Cross area of side flue, both boilers,	7·56 square feet.
" spaces between tubes above division plate or diaphragm (both boilers),	7·64 "
" " " below, " "	7·03 "
" smoke chimney,	8·73 "
Height of smoke chimney above grate,	48 feet.
Mean pressure of steam above atmosphere per square inch in boiler, with Cumberland coal,	14·67 pounds.
Initial pressure of steam above atmosphere per square inch in cylinder with Cumberland coal,	12·47 "
Cutting off at, from commencement of stroke of piston,	3 feet.
Double strokes of piston per minute, with Cumberland coal,	15·675
Consumption of Cumberland coal per hour with natural draft,	676 pounds.
Mean pressure of steam above atmosphere per square inch in boiler, with anthracite,	14·75 "
Initial pressure of steam above atmosphere per square inch in cylinder,	12·55 "
Cutting off at, from commencement of stroke of piston,	3 feet.
Double strokes of piston per minute with anthracite,	11·88
Consumption of anthracite per hour with natural draft,	713.

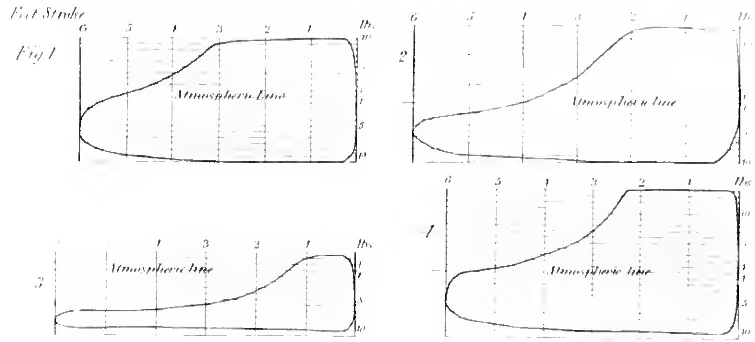
Proportions.

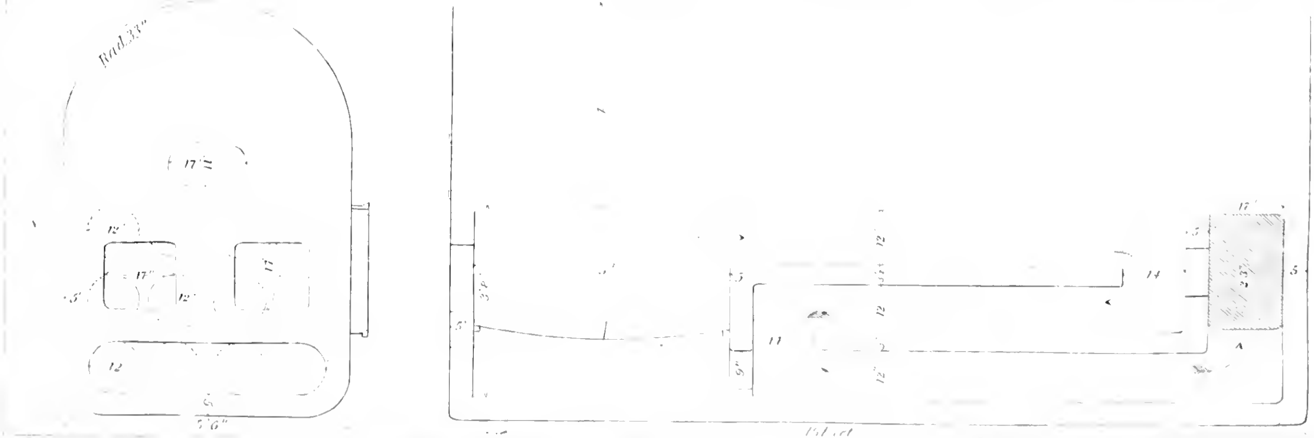
Proportion of heating to grate surface,	20·336 to 1·000
" grate surface to cross area of side flue,	7·090 "
" " " spaces between tubes above diaphragm,	7·016 "
" " " below "	7·624 "

Proportion of grate surface to cross area of smoke chimney,	6·126 to 1·000	
“ heating surface to cross area of side flue,	144·180	“
“ “ “ spaces between tubes above diaphragm,	142·670	“
“ “ “ below “	155·050	“
“ “ “ of smoke chimney,	124·857	“
“ “ per cubic foot of space displacement of piston,	25·699	square feet.
“ “ “ “ per double stroke per minute, taking the mean of the double strokes, with bituminous and anthracite coals, viz. 15·28 per minute, ...	1·682	“
Proportion of grate surface per cubic foot of space displacement of piston per double stroke per minute, . .	0·083	“
Proportion of grate surface per cubic foot of space displacement of piston, ...	1·264	“
Proportion of steam room per cubic foot of steam used per stroke of piston, ...	16·865	cubic feet.
Consumption of bituminous coal with natural draft per square foot of grate surface per hour,	12·600	pounds.
“ “ heating “ “	0·620	“
Sea water evaporated with bituminous coal by one square foot of heating surface per hour,	3·248	“
“ “ by 1 pound of bituminous coal per hour,	5·237	“
Consumption of authracite coal with natural draft per square foot of grate surface per hour,	13·300	“
“ “ heating “ “	0·658	“
Sea water evaporated with anthracite by one square foot of heating surface per hour, .	2·729	“
“ “ by one pound of anthracite per hour,	4·713	“

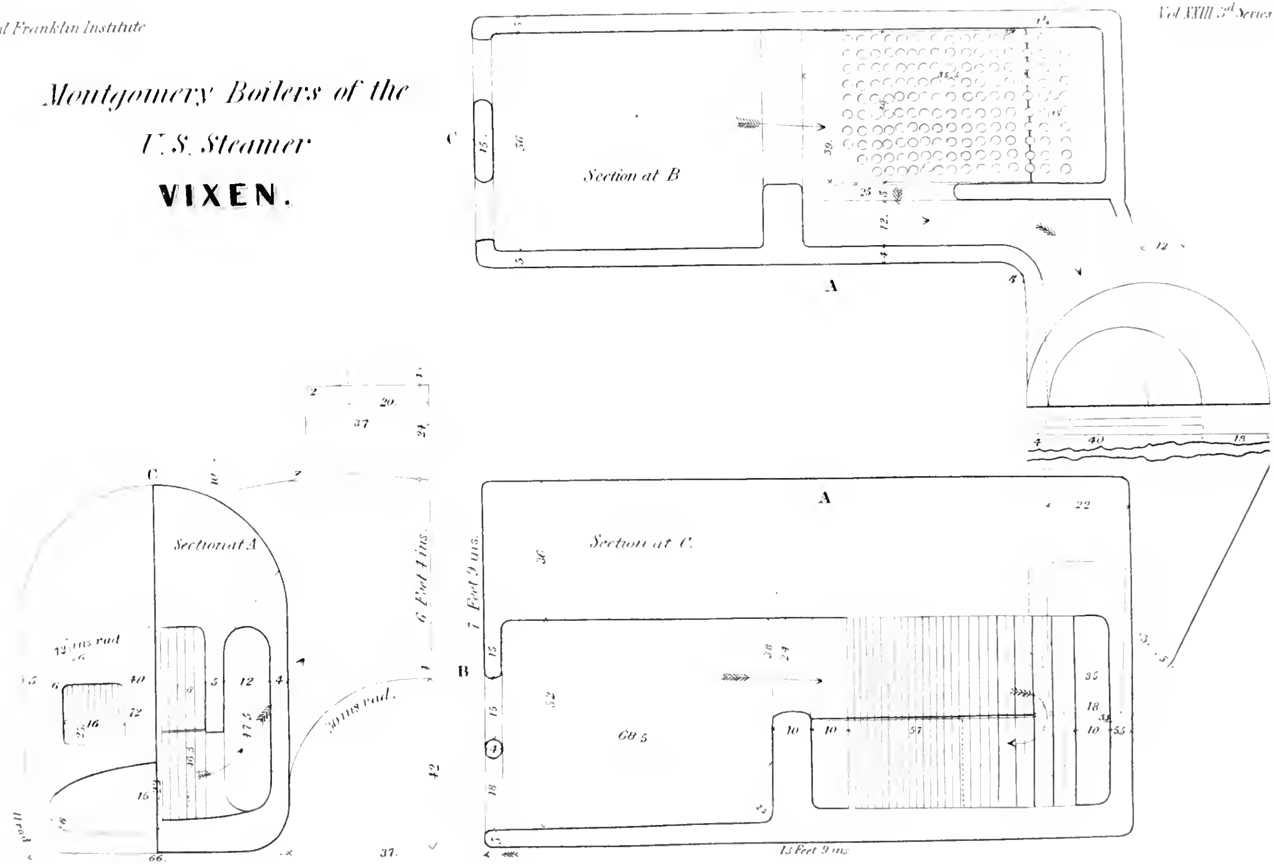
From the foregoing data, it will be perceived that the economical effect from the bituminous exceeded that from the anthracite by 11·12 per cent. of the latter, although the results from both kinds of coal are low. The cause of this is undoubtedly to be found in the proportions of the boiler. The proportion of least calorimeter or area of draft is but 1·000 to 7·016 of the grate surface, with a chimney only 48 feet high above the grate, and there was burned on each square foot of grate 12·6 and 13·3 pounds of coal. This calorimeter was entirely too small to furnish the necessary supply of atmospheric air for even the bituminous, much less for the anthracite, which, containing more of the carbon and less of the hydrogen constituent, requires a much greater amount of air for equal quantities of the coals. According to Prof. Walter R. Johnson, a pound of Cumberland bituminous coal requires for its combustion, 237·21 cubic feet of air at the standard temperature of 60° F., and 30 inches of the barometer; while the combustion of a pound of anthracite requires 340·42 cubic feet of the same air, or $30\frac{3}{10}$th per cent. more than the latter. There was thus not only this greater amount of air required for the anthracite, but there was a much less velocity of draft to furnish it, for as the anthracite evaporated a less quantity of water than the bituminous, (equal weights of each,) and as the amounts of the two kinds of coal burned in equal times may be considered practically the same, the difference being but $5\frac{3}{10}$th per cent. of the greater quantity, there was less heat present in the flues during the combustion of the anthracite, and consequently a less draft. Had the proportions of the boiler been proper for the combustion of anthracite, it would doubtless have given the superior result due to it theoretically, and obtained elsewhere practically,

Original Boilers of the U.S. Steamer VIXEN.





Montgomery Boilers of the U.S. Steamer VIXEN.



where proper conditions have been observed. With this greater deficiency of air for the anthracite than for the bituminous, a proportionally larger amount of the carbon constituent in the fuel went off in the form of carbonic oxide, instead of carbonic acid gas.

COMPARISON OF THE ORIGINAL WITH THE "MONTGOMERY" BOILERS.

The two kinds of boiler would supply equal amounts of steam in equal times, until the "Montgomery" choked up; while no choking up was experienced with the original boilers.

	Original Boilers.	Montgomery Boilers.	
Cubic contents of circumscribing parallelopipedon,	$1422\frac{2}{3}$ cu. ft.	1172.18 cu. ft.	or as 1.214 to 1.
Areas of grate surface,	47 sq. ft.	53·60 sq. ft.	" 0·877 "
Areas of heating surface,	750 "	1090·00 "	" 0·688 "
Areas of least calorimeter, proportionally to grate surface,	7·457	7·624	" 0·978 "
Height of chimnies above grates,	$43\frac{3}{4}$ feet.	48 feet.	" 0·912 "
Pounds of bituminous coal burned per hour per square foot of grate,	12 pounds.	12·600 pounds	" 0.952 "
Proportion of heating to grate surface,	15·958 to 1.	20·336 to 1.	" 0·784 "
Pounds of sea water evaporated per hour from 100° F. by 1 lb. bituminous coal,	4·107 pounds.	5·237 pounds	" 0·784 "
Pounds of sea water evaporated per hour by one square foot of heating surface,	3·089 "	3·248 "	" 0·951 "

Although the above figures show an economical evaporation in favor of the Montgomery boilers, in the proportion of 1·000 to 0·784, both burning bituminous coal, yet it must be remembered that with the original boilers, the bituminous was the Pittsburg variety, while with the Montgomery boilers, the bituminous was the Cumberland variety. Turning to the carefully conducted experiments of Prof. Walter R. Johnson, made at the government expense on various coals, I find the evaporation of fresh water from a temperature of 212° F., by one pound of Cumberland bituminous coal, to be 9·98 pounds, and by one pound of Pittsburg bituminous coal, to be 8·20 pounds, or the evaporative effects of the two coals compare as 1·000 to 0·821, or differing but $3\frac{7}{10}$th per cent. from the relative evaporation obtained in the *Vixen's* boilers.

Making the necessary allowance then, for the different evaporative powers of the different coals used, and for the fact of the one boiler being old and foul, and the other new and clean, there appears to be no superiority due to either *type* of boilers considered as such.

The indicator diagrams were taken during the performance of the Montgomery boilers, and are added to show the action of the cylinder valves, cut-off, &c.

INDICATOR DIAGRAMS FROM THE STEAM CYLINDER.

FIG. 1. Plate III.—Steam, per gauge in boiler, 12 lbs.; vacuum, per gauge in condenser, 26 in.; double strokes of piston per minute, 17; mean effective pressure per square inch, 16·6 lbs.; throttle wide.

FIG. 2.—Steam, per gauge in boiler, 15 lbs.; vacuum, per gauge in condenser, 24 in.; double strokes of piston per minute, 16; mean effective pressure per square inch, $14\frac{1}{3}$ lbs.; throttle wide.

FIG. 3.—Steam, per gauge in boiler, 5 lbs.; vacuum, per gauge in condenser, 25 in.; double strokes of piston per minute, 9; mean effective pressure per square inch, 5·6 lbs.; throttle close shut.

FIG. 4.—Steam, per gauge in boiler, $16\frac{1}{2}$ lbs.; vacuum, per gauge in condenser, 24 in.; double strokes of piston per minute, 14; mean effective pressure per square inch, 15 lbs.; throttle wide.

On Marine Propulsion. A Reply to J. W. Nystrom, Esq. *By* J. V. Merrick.

The reply of Mr. Nystrom to my remarks in the January number, presents so clear a case of misapprehension in the first principles of dynamics, that I think it will not be difficult, by reference to any treatise on that subject, to prove his positions entirely untenable.

Those positions, as nearly as I can understand them, are—1st, That there is some grand difference between the action of propellers and paddle-wheels, in virtue of which the revolutions of a screw may be considerably increased without altering the slip, while such a result cannot be expected when a paddle-wheel is employed; and, 2d, That "slip" is not a measure of loss of effect.

Let us examine the subject in detail. The effect of a constant force is composed, 1st, of the intensity of its effort, and 2d, of the space passed through; and consequently, its effect in a given time is the product of its intensity and its velocity. This effect has received from different authors various names, of which the "quantity of work" appears to be the most expressive.

It follows from this definition, that when no velocity is obtained, or in other words, when a body in which a force acts is immovable, there is no "work" expended; and it follows also, that if a constant force is acting to separate two bodies, its intensity of effort, which may be called its resistance or pressure, will act equally on each body, and the quantity of work expended on each, will be expressed by the product of this intensity, or resistance, or pressure, and of the velocity maintained by each; and that the sum of these products must always equal that of the original pressure or intensity of effort, and of its velocity.

Now, suppose the case of a locomotive moving upon a railway; the driving wheel may be considered as a lever, through which the power developed by the engine is transmitted to the rail, each point of which, as the moving driving wheel comes in contact therewith, forms the point d'appui against which acts the power of the engine to propel itself and train; and if this power be equivalent to a weight of 100 pounds constantly acting at the velocity of the circumference of the driving wheel, then if the friction or "hold" upon the rail just equals 100 pounds, the wheels will turn without slipping upon the rail; in this case, the velocity of the train in a unit of time, multiplied by the resistance it offers to motion at that velocity, just equals the whole available power of the engine in that time. But if the power developed by the engine be increased by the employment of larger cylinders with the same steam pressure, this power transmitted to the circumference of the driving wheel will be increased either in intensity or in velocity. As, however, the friction was before just equal to the resistance offered by the train at its former velocity, and as the pressure can never exceed the friction or resisting pressure, the increase must take place in the velocity. But the velocity of the train cannot be increased, because it requires a pressure equal to the friction, to give it that velocity. Hence the circumference of the driving wheel must revolve faster than the engine can advance,

or in other words, must slip upon the rail. The ratio of this "slip" to the velocity of the driving wheel, is the per centage employed in what may be called *propelling the friction backwards*, which is non-utilized effect.

In the case of a paddle-wheel steamer, supposing there is no oblique action, and that the whole area of the float is concentrated at the centre of effort, the rail is replaced by the water, and the friction of the rail by the power required to put in motion that water. Now as water is a body whose particles are free to move upon one another, it follows that no pressure can be applied to it without producing motion; hence the power transmitted to the centre of effort revolving at a certain velocity, must not only give rise to a forward motion of the vessel, but to a retrograde movement of the water, called "slip;" and by the law of dynamics, previously mentioned, the available power of the engines when uniform motion is attained, will therefore be divided as follows: 1st, the pressure at the centre of the float will give rise to a certain velocity of the vessel, dependent on its form and dimensions, the product of which, by this pressure, expresses that portion of the power expended in propelling the vessel, and is called "utilized effect;" 2d, the same pressure at the centre of the float, will give rise to a certain velocity of the water, in a sense opposite to that of the vessel's motion, dependent on the form, dimensions, and arrangement of the floats on the wheel, which velocity multiplied by the said pressure, expresses that portion of the power employed in propelling the water backward, and is called "non-utilized effect." As the same pressure is an element in both these expressions, and as the sum of the two effects must be equivalent to the available power of the engines, it is obvious that the sum of the two velocities is equal to that of the centre of pressure of the float, and that the ratio of non-utilized effect to the whole power available, is measured by that of the velocity of the slip to the velocity of the wheel.

If this be not clear enough, the case may be stated in another way. Suppose a paddle-wheel steamer to be tied to a wharf, her engines to be in uniform motion, and steam of a given pressure to be admitted freely to the cylinders. Then, according to the relative velocities of the wheel and the crank pins, this power becomes at the centre of effort of the former, equivalent to a certain velocity multiplied by a certain pressure, which is capable of giving a certain velocity to the water put in motion by the floats, depending on their form, arrangement, and dimensions. Here the whole effect of the engine transmitted through the shafts, is non-utilized in propelling, because the vessel has no velocity. If, now, the engines being still working with the same steam pressure, the vessel be untied, after the first instant of time, if we can suppose uniform motion to be attained during an indefinitely short period, the retrograde velocity of the water will have been diminished, that of the vessel (forward) increased, (since it was before = 0,) and that of the engines increased, thereby augmenting the *power* developed, although the *pressure* remains precisely the same as before. At the end of successive instants of time, the same effects will be exaggerated, the *pressure* always remaining the same, until an absolute uniformity of motion is attained; when it will be found that the opposing resistances are in equilibrium.

(not the opposing *effects*,) and that the resistance of the water thrown back by the wheels, is precisely equal to the resistance opposed by the water and air to the advance of the vessel. And then, the ratio of the coefficient* of the vessel, and of the area of the floats brought into action while the vessel goes over an unit of space, multiplied by the coefficient for resistance to plane surfaces at the given immersion, determines (inversely) that of the velocity of the vessel, forward, to the velocity of the water backward.

For example, if the coefficient of a vessel be 40, and the area in feet of the propelling surface of the floats, acting while the vessel advances through a unit of space, $=240$, then the slip should be $\frac{40}{240+40} = \frac{40}{280} = \frac{1}{7}$ or 14 per cent., nearly.

The same principles must govern us in the consideration of the screw propeller. Suppose, as before, that a screw vessel is tied to the wharf, and steam of a given pressure freely admitted to the pistons, which are in uniform motion; then the power developed, after the requisite deductions are made, is transmitted through the shaft, and according to the ratio of velocities of the pitch of the screw, and of the crank pins, becomes at its centre of effort, a certain pressure exerted in the direction of the axis, which pressure is capable of giving a certain velocity to the water put in motion by the propeller blades, depending on their form, arrangement, and dimensions. Here the whole available power of the engines is non-utilized effect, since the vessel has no velocity. If, now, the vessel be untied, and if after the first instant of time we suppose uniform motion to be attained for an indefinitely short period, the retrograde velocity of the water will have been diminished, the forward velocity of the vessel increased (since it was before $= 0$,) and that of the engines increased, thereby augmenting the power developed in a given time, though the *pressure* on the propeller remains the same. At each successive instant of time, the same effects will have been exaggerated, until at length uniform motion will be attained, when it will be found that the opposing *pressures* are in equilibrium, or in other words, that the resistance of the water thrown back by the propeller, is precisely equal to the resistance opposed by the water and air to the forward motion of the vessel; and that the ratio of the coefficient of the vessel to the projected area (in square feet) of the blades acting while the vessel passes through an unit of space, multiplied by the coefficient resistance per square foot to a plane surface, will be inversely that of the relative velocities of the vessel and of the water in opposite directions.

For example, in the case of the San Jacinto, the pressure required to propel her at a velocity of $\frac{968}{60} = 16{\cdot}11$ feet per second, was (by dynamometer) 12,815 pounds. Hence her coefficient was $\frac{12{,}815}{16{\cdot}11^2} = 49.3$.

* By the "coefficient" of a vessel, I mean that number which, multiplied by the square of its velocity, and by the mass of a cubic foot of water, equals the number of pounds required to propel her at that velocity; for sea water the mass $= \frac{P}{2g} = \frac{64{\cdot}5}{64{\cdot}33}$ or $1{\cdot}$, nearly.

The area of her propeller blades projected on a plane perpendicular to the axis, is 108·5 sq. feet. But the projected area acting to propel, while the vessel is advancing over a unit of space, is (as I shall hereafter show,) equal to that of the propeller, in rest, multiplied *by the secant of the angle, whose tangent multiplied by the circumference, is the advance of the vessel during a revolution.*

The coefficient of plane surfaces propelled through liquids, is various at different speeds, and under different circumstances. Beaufoy, in one set of experiments, found it to be for water (near the surface) 1·08; and in another set, 1·12. (Theoretically it should be $\frac{P}{2g} = \frac{64 \cdot 50}{64 \cdot 33} = 1$, nearly, for sea water; P being the weight of a cubic foot,) and it of course varies with the immersion. As we are now viewing the theory of the screw, however, and cannot ascertain its value within the limits of 1· and 1·12, we shall assume it $= 1 \cdot 00$, which will be near enough for the purpose.

At twenty-five per cent. slip of the San Jacinto's propeller, the secant of the angle before mentioned, which is $\frac{(\text{circ.})^2 + (\text{advance})^2}{(\text{circ.})^2} = 1 \cdot 40$, so that its acting area was $108 \cdot 5 \times 1 \cdot 40 = 151 \cdot 9$ square feet. Hence the slip should be $\frac{49 \cdot 3}{151 \cdot 9 + 49 \cdot 3} = 24 \cdot 5$ per cent., while the slip observed $= 26 \cdot 27$ per cent.; while the velocity of pitch if this were the correct slip would be $16 \cdot 11 \left(1 + \frac{24 \cdot 5}{100 - 24 \cdot 5}\right) = 21 \cdot 33$ feet per second. This is as near a result as calculation will give, when it is considered that a part of the blades near the axis were probably not efficient, or that from disturbing influences, the coefficient was less than 1. If for example, it were ·911, then $\frac{49 \cdot 3}{(151 \cdot 9 \times 911) + 49 \cdot 3} = 26 \cdot 27$ per cent.

Enough has, I think, been said, to show that *the pressure constantly exerted by a screw propeller or side wheel, always remains the same with a given pressure in the cylinders, and is entirely* independent of the velocity at which the vessel moves. Hence in the case of the tow-boat, (adduced by Mr. N.,) the *pressure* exerted by her propeller or wheel, is always the same with the same steam pressure, no matter what number of vessels she may have in tow; and the effect utilized, would therefore be always in exact ratio with the difference between unity and the per centage of slip, provided the acting area of the propeller was the same. Let us suppose as an example, that the San Jacinto should take in tow another vessel possessing the same coefficient, and that steam of the same pressure as before, be admitted to her engines. The sum of the coefficients would then be $49 \cdot 3 \times 2 = 98 \cdot 6$. Then the velocity at which the vessels would move, would be $\sqrt{\frac{12815}{98 \cdot 6}} = 11 \cdot 4$ feet per second. In order to approximate the acting area of the propeller, suppose the slip to be 41 per cent., then secant $\vartheta = 1 \cdot 28$, and $108 \cdot 5 \times 1 \cdot 28 = 139$ feet.

Hence slip $= \dfrac{98{\cdot}6}{139 + 98{\cdot}6} = 41{\cdot}4$ per cent. So that the velocity of the pitch will be $11{\cdot}4\left(1 + \dfrac{41{\cdot}4}{100-41{\cdot}4}\right) = 19{\cdot}47$ feet per second. Hence the powers developed by the engine will be in the two cases, as 21·33 to 19·47, or as 1· to ·913, while the utilized effects produced, are as $(16{\cdot}11)^3$ to $(11{\cdot}4)^3 \times 2$, or as 1 to ·709. In like manner, we may find for the cases, when two such vessels are towed, a slip of 53·2 per cent.

"	three	"	"	"	" 61·0	"
"	four	"	"	"	" 67·4	"
"	five	"	"	"	" 71·8	"
"	six	"	"	"	" 75·0	"

The acting area of a screw has been supposed by some authors to be the projected area of all its blades on a plane perpendicular to the axis; by others, to be their absolute area, on the supposition that their action is perpendicular to the surface; by others, again, the area of the circumscribing circle. It appears to me, however, to be neither of these; but the projected area by the ratio of length between the helicoidal path traversed by the centre of effort, and the circumference of the circle in which it moves; and for the following reason: the coefficient of a vessel (before alluded to) represents the area of a plane, whose resistance would be equivalent to that of the vessel; consequently the quantity of water which may be said to be displaced by the vessel, is that which would be displaced by this plane, or is equivalent to the product of its area and of its advance. Now the water displaced by the blade of a screw, is a volume whose area is that of the helicoidal path traversed by the whole blade, and whose length is the slip; with the velocities of these two displacements, we have nothing to do; we have simply to compare the "acting area" of the blades, and the "propelled area," as it may be styled, or coefficient of the vessel; and as the area of the helicoidal path of the whole blade is to its projected area on a plane perpendicular to the axis of the screw, as the secant of the angle it forms with that plane is to unity, it results that the product of this projected area by the secant of this angle, is the "acting area" of the blades. Or, it may be thus stated: each point in the surface comes in contact with, and therefore sets in motion, every particle of water it glides over during its revolution, and as the aggregate of all these particles forms the helicoidal line traced by the blade, it is clear that a body of water is moved during its revolution by that point, proportional to the length of that line. Now if the vessel have no motion, this helicoidal line becomes the circumference of the circle in which it moves; and if the vessel have any forward movement, the angle formed by the helicoidal path over which the centre of effort passes, is such that its tangent, multiplied by the circumferential movement, equals the advance; and it is this angle whose secant forms the multiplier for the projected surface of all the blades, to obtain their acting area. It thence follows that this area diminishes as the slip increases, of course diminishing the resistance requisite to put the water in motion.

With a paddle-wheel, the reverse is the case; there the number of floats immersed during the advance of the vessel over a unit of space,

increases with the slip. For example, if a paddle-wheel have 30 floats, and if 20 revolutions cause its centre of effort to move over 1000 feet, and its propelling area = area of floats immersed, $\times \frac{30 \times 20}{1000} = \cdot 60$ N.; then if the vessel advances over only 900 feet, (or if the slip is ten per cent.,) the number of floats immersed during its passage over 1 foot, would be $\frac{30 \times 20}{900} = \cdot 67$ N.; if over 800 feet, with 20 per cent. slip, $\frac{30 \times 20}{800} = \cdot 75$ N., and so on in the ratio of $\frac{1}{1-S}$, and as the volume of water set in motion is equal to its area multiplied by the recession of the water, while that of the water displaced by the vessel, is equal in value to the area expressed by its coefficient multiplied by its advance; and inasmuch as we have nothing to do with the *velocities* with which either volume is moved, we have to compare the acting and propelled areas, which in this instance approach in value as the slip diminishes.

Such are the indications of theory; but it is found that the values given by them, are but approximative, and that there are some modifying circumstances experienced in practice. Among others, may be noticed the fact, that as propelling surfaces approach more nearly to each other, or follow each other more rapidly, the disturbance of the water diminishes their efficiency; that water impinging on surfaces at more oblique angles, increases its pressure more rapidly than is justly due to its velocity, and that consequently, it opposes greater resistance to surfaces striking it at very acute angles; that the lines of a vessel astern, have great influence on the resistance offered to its propeller by the greater or less facility with which the water falls into the wake; that the coefficient of a vessel increases at high rates of speed, &c., &c. The great principle, however, remains the same, viz: that *slip* with the same relative propelling area and coefficient, *is a measure of loss of effect*, and that in all propelling agents (now known), the change in propelling area at different slips within the ordinary limits, when taken in connexion with the different resistances offered by the water under these different circumstances, is not so great as materially to affect this condition in practice.

And now for a notice of some of Mr. Nystrom's observations. In the first place, when quoting my remark, that "heavy weather at sea" is apt to increase slip; he adds, "we may as well say a good fair wind, which then would decrease the slip; these are the results of circumstances." What has been said will show that the "circumstances" are generally on one side of the question, and that while a very moderate increase of resistance increases slip, it requires a far greater force to equally diminish it. In fact, the experience of all screw steamers is, that the average slip during an ordinary voyage, is greater than that attained under the favorable circumstances of smooth sea and calm. In the next place, it is unnecessary to recapitulate in order to show that the same general principles cover the case both of paddle-wheels and propellers, when it is a question if velocity can be increased with the same resistance and slip. 3d, Mr. N. says, that "if we suppose the slip to be 100· (that is, when the vessel

stands stationary, and the propeller is running,) and the slip is a measure of the loss of effect as described by Mr. Isherwood, then the slip should take away *all the effect* from the steam engine, and not allow any for the friction and working the pumps." Now these latter elements have nothing to do with the question; they are absorbed and utilized before the power developed by the cylinders reaches the shaft; consequently, are not transmitted to the propeller, and do not form a part of the total power in which the per centage of loss is calculated. If, for instance, a power of 100 horse power be developed, and it require 10 horse power to overcome friction, &c., it is but 90 horse power which is transmitted to the propeller. Again, with reference to the tow-boat question.

"Again, let us take a few steps back, and suppose the slip to be 80 per cent., which is often the case with tow boats; then, if the loss of effect is 80 per cent., there is only 20 per cent. left, which is nothing more than what is required for the friction and working the pumps, consequently nothing left as useful effect for towing; still the vessel is running, and in this age of common sense, we do not believe that witchcraft tows the vessel; take the same tow boat to tow a smaller vessel, which causes a slip of only 50 per cent.; the friction and working the pumps being the same, 20 per cent., then there remains 30 per cent., as useful effect for towing. We see now that if slip is a measure of loss of effect, it requires more power to propel a small vessel, and no power to propel the largest vessel."

Here we find the same error as in the former case—the whole structure of the argument is built upon sand. Again, in reference to the comparison of a locomotive with a steam vessel, it is intimated that if we "try the experiment with a locomotive in water, we shall find it run as well without wheels." Undoubtedly; it would probably sink—but if that difficulty were overcome, it would advance quite as rapidly as the finest screw vessel, if drawn upon shore, and her engines were driven at full power. The comparison is entirely irrelevant—as much so as to assert that a man exercised no power in walking, because, if suspended in the air, he could not advance by the same movements of his limbs.

Finally, The calculation into which Mr. N. enters at the conclusion of his article, is a lamentable instance of implicit faith (without examination) in the old doctrine that "action and re-action are equal and in opposite directions;"—a form of expression which ought never to be quoted or used without the substitution of the proper terms, "pressure and resistance" for "action and re-action."

The very first equation given in that calculation is erroneous—it should have been $p=r$;—consequently the results attained by it are valueless.

It is unnecessary to quote or reply at greater length, although the question is by no means exhausted—and with any persevering reader who may not have "dropped off" ere this, I shall rest what I believe to be a "clear case."

For the Journal of the Franklin Institute.

Description of the Steamer "City of Norfolk."

This steamer, constructed in Baltimore, has been recently put on the New York and Richmond line. She was built for Messrs. Mailler & Lord, of New York, Agents and part owners.

HULL—Bell & Brothers, Builders.

Length between perpendiculars, .	165 feet.
" on deck, ...	180 "
Breadth of beam, ...	27 "
Depth of hold, ...	17 " 3 inches.

Midship section immersed at trial, 240·67 sq. ft.
Tonnage: Register, 571 tons; Carpenter's measure, 729 tons.
Rig, 3 masts; fore and aft sails.

ENGINES—By Murray & Hazlehurst, Vulcan Works.
Cylinders—two: inverted, direct action, and connexion.

Diameter, . . .	2 feet 8 inches.
Length of stroke, . .	2 feet 8 inches.

One Air Pump, solid piston, double acting, driven by beam and connecting rod from main crank shaft.

SCREW—Of Cast Iron.

Diameter, . . .	9 feet 2 inches.
Pitch, (expanding,) .	15 feet 6 inches at entrance. 19 feet at exit.

3 Blades; absolute width at periphery, 4 feet 9 inches.
" at hub, 1 foot 6 inches.
Fore shortened view on disk, at periphery, 4 feet 1 inch.
" " " at hub, 6 inches.

Absolute area of all blades, . .	44·6 sq. ft.
Projected " " . . .	24·7 sq. ft.
Thickness at periphery, . . .	$\frac{5}{8}$ inches.
" at hub, ...	4 inches.

BOILERS—Two: flue and return tubular.
External dimensions—width 8 feet; length 18 feet 2 inches.
Heating surface, both boilers, 1824 sq. feet.
Grate " " " 44 sq. feet, or in the ratio of 21·71 to 1·00. Each boiler contains 2 flues $18\frac{1}{2}$ inches, 2 flues $14\frac{1}{2}$ inches, and 2 flues $10\frac{1}{2}$ inches diameter, 8 feet 2 inches long, and 75 tubes 4 inches diameter, $6\frac{1}{2}$ feet long, the upper tubes on a level with crown of furnace.

Collective area, both boilers, of flues,	14·44 sq. feet.
" " " of tubes,	15·70 sq. feet.
Ratio to grate surface of flues, . .	$\frac{1}{5\cdot82}$
" " " of tubes, . .	$\frac{1}{5\cdot35}$?

Chimney, 56 inches diameter, or area 17·1 sq. feet, and 55 feet high above grate bars.

Performance in the Bay on first trip from Baltimore to New York.
Revolutions averaged 60 per minute.
Steam averaged 20 to 22 lbs., cutting off at half stroke.
Speed averaged 10·22 miles per hour, as follows:
Time 6 hours 39 minutes.
Distance run 68 miles, by United States Coast Survey Charts.
Draft of Water—Forward, 10 feet 4 inches.
" " Aft, 12 feet 6 inches.
Ship very deep, and drawing too much by the stern.

Fuel—Consumption not accurately ascertained, but estimated at 1300 pounds per hour.

Slip—Mean pitch $=\frac{19+15\cdot5}{2}=17\cdot25$ feet. The velocity normal to pitch was $17\cdot25\times60\times60=62{,}100$ feet$=11\cdot76$ miles per hour.

Slip, therefore, $=\frac{11\cdot76-10\cdot23}{11\cdot76}=13$ per cent., a very excellent result.

M.

For the Journal of the Franklin Institute.

A Series of Lectures on the Telegraph, delivered before the Franklin Institute. Session, 1850–51. *By* DR. L. TURNBULL.

Continued from page 191.

The Electric Telegraph between England and France. Extension to Ireland and Belgium.

The first wires for the Submarine Telegraph were sunk in the British channel on the 27th of August, 1850. The wire was thirty miles long, with a covering of gutta percha half an inch in diameter, the wire imbedded by leaden clamps of twenty and twenty-five pounds, to the bottom of the sea; the clamps were streamed out at every sixteenth of a mile, and the wire was safely sunk to a depth which was hoped would place it out of the reach of anchors or monsters of the deep; and the other end of the wire was run up the cliff at Cape Grinez, to its terminal station on the French side of the channel, and messages were passed between the two countries.

But unfortunately for the first effort, in the course of a month, the wire received so much injury on a rock off Cape Grinez, as to make it entirely useless, and upon a careful consideration, the Directors of the Company determined to lay, instead of one, "four permanent wires."

Upon an examination by divers, it has been found that where the rupture of the coil occurred, it had rested on a very sharp ridge of rocks, about a mile out from Cape Grinez, so that the leaden weights, hanging pannier-like on either side, in conjunction with the swaying of the water, caused it to part at that point; while at another place, in shore, the shingle from the beach had the effect of detaching the coil from the leaden conductor that carried it up the Cape.

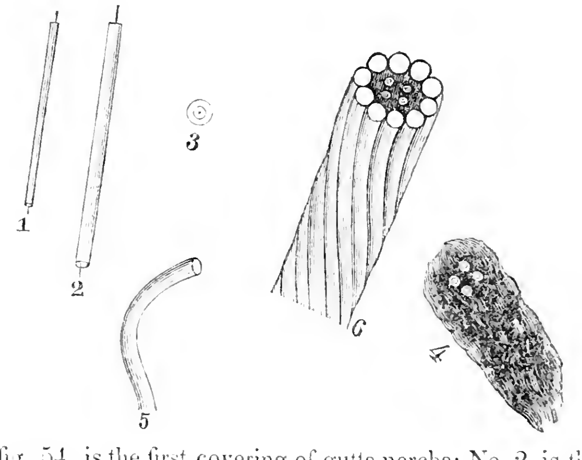
The wire, in its gutta percha coating, was consequently cut in two places, representing a remnant of wire of about four hundred yards, which was allowed to drift away, till it came into the possession of a fisherman of Boulogne; and it was no wonder that it was cut, being represented as not thicker than a lady's stay-lace, while it ought to have been as thick as the cable of those placed in the Britannia tubes in position, say eight or ten inch cable, and to be submerged below five fathoms, by the aid of enormous weights, so as to avoid all currents.

In the *London Mining Journal* for November, 1850, Mr. J. J. Lake, of the Ordnance Office, Plymouth, proposes, in order to prevent injury to the telegraphic wires, from the nature of the bottom, to suspend them

by corks placed at intervals, and to secure them to the bottom by anchors or a dead weight, at certain greater distances, and at each anchor, or weight, a small buoy, with a flag, could be secured, which would indicate their locality; and in the event of accident, they could readily be found.

I will now state the present condition of this communication, and the means taken to secure it from accident; and I will then describe the form of telegraph which is employed by Mr. Brett. In *L'illustration Journal Universel*, for October, 1851, it is stated that in this, the last effort, they had not calculated for the proper amount of cable, when first taken across the channel, it requiring a mile more cable, but the accident was soon repaired. The engraving is one taken from that Journal, and they remark that it is indeed a wonderful work. The cable of wire in which is enclosed the electrical conductor, was manufactured in the short space of three weeks, by means of a machine, the invention of Mr. Fenwick, an ingenious English engineer. It is hoped, that to preserve the conducting wire free from accidents which caused the first experiment to fail, by the present arrangement four wires are enveloped in a double cover of gutta percha, and each re-covered with cable lying at the bottom of the sea. The covers forming, together, a length of ninety-six miles, over which is placed a linen covering prepared in a composition of tar, tallow, &c., and crossing its length the centre of the cable.

Fig. 54.



No. 1, fig. 54, is the first covering of gutta percha; No. 2, is the second covering, re-covering the first; No. 3, section of the covering No. 2; No. 4, is the wire in the covering of tarred linen; No. 5, is the simple wire of galvanized iron; the covering is that of zinc; No. 6, is a view of the arrangement of the cable, showing the galvanized iron wire, &c.

To recapitulate:—The rope is 24 miles long, and consists of four copper wires, through which the electric current will pass, insulated by coverings of gutta percha. These are formed into a strand, and bound round with spun yarn, forming a core or centre, round which are laid ten ir on galvanized wires of 5-16ths of an inch diameter, each welded

into one length of $24\frac{1}{2}$ miles, and weighing about fifteen tons. The rope weighs, altogether, about 180 tons; it forms a coil of 30 feet in diameter outside, 15 feet inside, and five feet high, and was in good working order in September, 1851. English papers received by the arrival of the Niagara, on Friday, December 12th, 1851, state that the Sub-marine Telegraph is working well. Messages on the same day have been transmitted from London and Liverpool to Paris, Havre, Vienna, Trieste, Hamburg and Ostend; and in one instance, a communication was forwarded to Cracow, to be despatched thence by mail to Odessa.

The rates are, for a message of twenty words:—

From Paris to Calais.	7f. 56c.
" " Dover, ...	19f. 56c.
" " London, ...	32f. 81c.
" " Birmingham, ...	—— ——

From Paris to Brighton, Cheltenham, Coventry, Gloucester, New Market, Norwich, Oxford, Portsmouth, Southampton, &c., 26f. 03c.

From Paris to Chester, Edinburgh, Glasgow, Holyhead, Liverpool, Manchester, New Castle, Nottingham, Sheffield, York, 29f. 31c.

Now that the English channel has been crossed in so substantial a manner, and with such perfect success, the crossing of the Irish channel must follow; for the same Company will perform this important work.

By their act of incorporation they are styled "The Submarine Telegraph Company between England and France, between England and Ireland, and the European and American Printing Telegraph," all proposed by Mr. Jacob Brett, in 1851.

Messrs. Carmichael & Brett have contracted with the Belgian Government for the formation of a submarine telegraph between Belgium and England. They are to have a monopoly of ten years, and the governments are to have priority of all messages.

Description of Brett's Printing Telegraph, Plate IV.

Suppose at one extremity of *a single line* of telegraphic wire, a small key board, containing a row of ivory keys, marked with the letters of the alphabet, and other characters or words; and that it be connected by the said wire to the printing machine at the other extremity. This machine contains a type wheel, having on its circumference corresponding letters, words, or signs; a slight electric power is sufficient to regulate the motion of the whole, so that the instant a key representing any word, letter, or sign, is pressed down by the person at the key board at one end of the line, the corresponding word, letter, or sign of the type wheel prints, and the signal bells ring at the other end of the line of telegraph, without limit as to distance. The communications are printed on paper supplied from a scroll of unlimited length, from which any portion of the correspondence may be cut off at pleasure.

The motive power is simple; it being that of a weight, which sets in motion the key shaft and governor of the key board; and the circuit wheel in connexion with the shaft being put in contact with the wire of the galvanic battery, or other generator of electricity, according to the velocity of motion and manipulation at the key board, so will the motion be fast or slow at the printing end of the telegraph; the type wheel of the

BRETT'S
Electric Printing Telegraph.

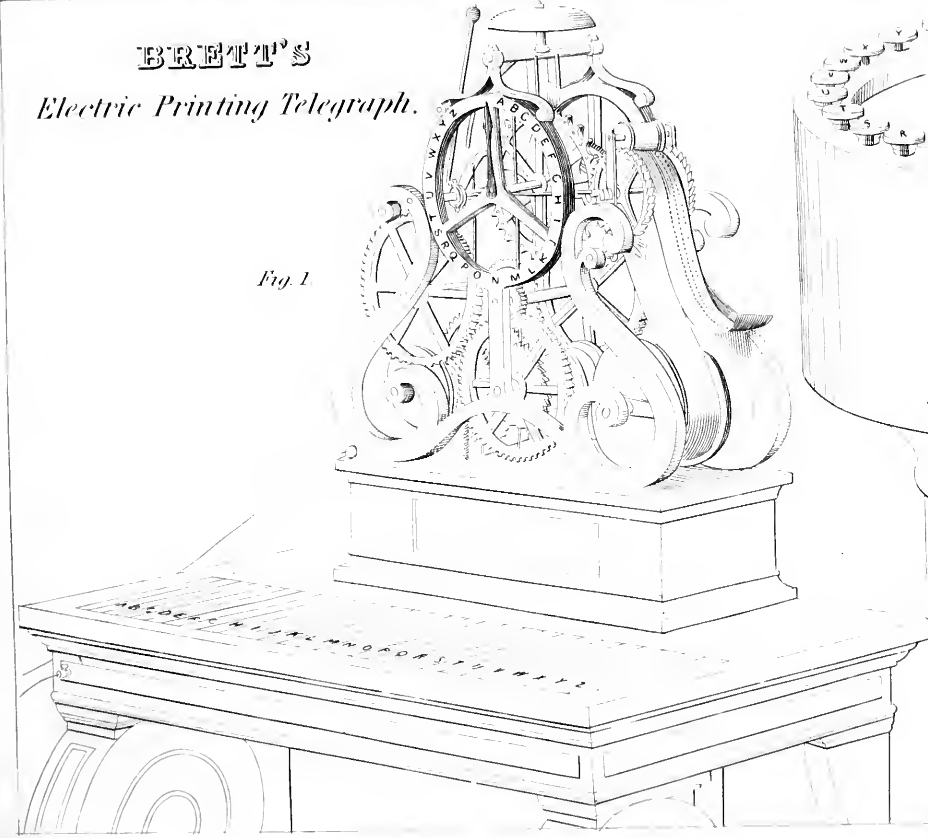


Fig. 1.

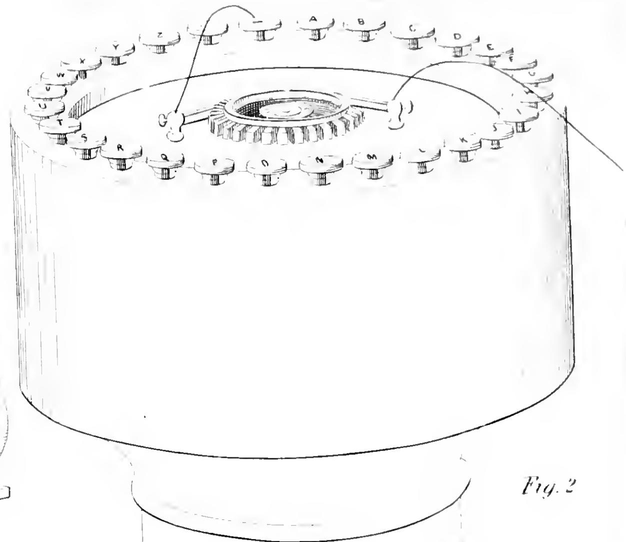


Fig. 2

telegraph is set at liberty by means of an escapement, and weights in connexion with it, so as to print with a like velocity, in combination with an hydraulic or pneumatic regulator, which admits of the desired letter *only* being printed, by checking and releasing an eccentric arrangement; a rod from thence unites with the cylinder on which the paper is printed, in various modes, as may be desired, either in paragraphs—on a sheet of paper—upon a long strip of ribbon or paper—or, if for government despatches and the like, it can be printed line by line, like the column of a newspaper, of an unlimited length.

Fig. 2 represents a separate key board, of a circular form, from which communications can be forwarded to any or every station in connexion with it, the letters, words, or characters being arranged round it on the keys; and these, if depressed by the fingers, will check the motion of a pin, or shaft, and also of the circuit wheel fixed to the same axis, at such given point or key, by which means the operator may make or break the circuit of conductors at such letter or point.

The distance actually proved to act by this telegraph in one continuous line has been 230 miles, and 340 miles apart, at the rate of 100 letters per minute. This is a modification of the House Printing Telegraph.

From the year 1847 to that of 1852 there have been so many fancied improvements made in electro-telegraphs, that it is unnecessary to consume time in describing them. The most important I have noticed in full; but in the majority, I have only described a new claim, or a good modification of an old arrangement.

The three most interesting telegraphs which have been devised in that time, are those of Henley & Foster, of England; Siemens, of Berlin, and Allen, of Edinburgh. I have arranged them chronologically, and have given a list of the publications where they may be found, especially in the instances where the description given here is limited.

Nott's Improvement in Electric Telegraph, January 20, 1846.—Novel arrangement of apparatus, by which audible and visible signals can be given, through the agency of electro-magnetism.—Rep. Pat. Inventions, 1847, p. 97.—(Irish.)

Hatcher's Improvements.—First, consisting in arranging and disposing of magnets in such a way that when an electric current is transmitted through them, gives a step by step motion. The second relates to the means of forming the metallic connexions. Third, in regulating a number of clocks.—Patent, dated March 23, 1847.—(English.)

Reid's Electro-Telegraphic Improvements.—Better insulation of the wires, by laying them in channels under ground, and covering them with gutta percha, marine glue, or tar; using a modified galvanometer to sound an alarm, and earthenware insulators.—Patent, dated Nov. 23, 1847.—(English.)

Henry Mapple, Wm. Brown, and James Lodge Mapple, Telegraphic Machine, June, 1847.—They magnetized a steel dial by electricity, and thereby made a steel pointer to move over it.—Rept. Patents, Feb., 1848.

Barlow and Foster's Improvements in Electric Telegraphs, April 27, 1848.—First, coating the telegraphic wires with a compound, consisting of one part by weight of New Zealand gum, and one part of milk of sulphur, added to eight parts of gutta percha, by little and little, while in a

kneading trough, at a temperature of 120° Fahr. The coating is effected as follows:—Two pairs of rollers are made to revolve by means of suitable gearing, at one uniform speed, and each pair is provided with a pipe, fitted steam-tight, to one end of their axis, through which pipe steam is admitted at pleasure, which serves to bring the rollers to a temperature sufficient to soften partially two bands of gutta percha, passed between them. Then, there is another pair of rollers, which have their surfaces cut with semi-circular grooves; the grooves of the one roller corresponding or falling right over those of the other. The wires to be covered are wound upon reels, from which they pass between the second pair of rollers. The bands or fillets of gutta percha are passed between the first pair of rollers, (and are so brought into an adhesive state,) and the two bands of gutta percha, with the wires between them, are in this state passed between the second pair of rollers, by which the fillets of gutta percha are made to adhere together, and consequently to envelope the wires.

2d, The governing the currents of electricity, so as to cause each pulsation thereof, separately or conjoined, to indicate different signs or symbols.

3d, The patentees describe an electric telegraph apparatus for indicating the passing and time of passing of a railway train.

A dial is pierced with fifty holes at regular distances, in which holes small plugs are placed. This dial is made to revolve once every hour. A metal spring presses against the face of the dial, and has the effect of thrusting back any plug that may have been protruded. Above the dial is an electro-magnet, which attracts, on the passing of an electric current from the station which the train has just passed, one end of a lever, the other end of which protrudes the plug immediately underneath beyond the face of the dial, so that the attendant is enabled, by looking at the dial, to see whether the train has passed the station, and what time has elapsed since it passed.—*London Mech. Mag. No.* 1319, *Nov.* 18, 1848.

C. F. Johnson, Oswego, Tioga County, New York.—Improvement in Electric Telegraphs, May 16, 1848.—Claim.—First, forming signs for telegraphic purposes, by the dropping of balls upon an endless belt moving with an uniform velocity. Second, I claim the taking off impressions on paper, from balls as dropped substantially in the manner described.—*Franklin Institute Journal, Vol.* xvii, 3*d series, p.* 310.

John Lewis, Recardo, Lownds Square, Middlesex, England, Sept. 18, 1848.—1st, "Improvement" to a mode of insulating wire for electro-telegraph purposes; and 2d, to an apparatus for suspending them.—*Mechanics' Magazine, March*, 1849.

Edward R. Roe, Improvements in the Machine for Operating or Manipulating Morse's Electro-Magnetic Telegraph, May, 1849.—"The invention consists, 1st, of movable metallic types as conductors of electricity or galvanism; 2d, a metallic type bed upon which they are to rest, (which is also movable to and fro, somewhat in the manner of a common printing press;) and 3d, a movable board, which is also a conductor, and is made to traverse the face of the types, thereby making, continuing, or breaking the galvanic circuit, according to the form of the types.

Claim.—"What I claim as my invention is, 1st, The combination of

the body, the socket, the spiral ring, and the wand, with its conducting point and its non-conducting inclined planes, the whole constituting the traverser.

"2d, I claim the manner of giving the proper motion to the traverser, by the combination and action of the traverse wheel, the pully, and the cord which plays in it, the teeth upon the traverse wheel and the brakes operated by the type bed, in the manner set forth.

"3d, I claim the combination, for telegraphic purposes, of the types, arranged in the manner described, with the traverse and its wand, and its conducting point guarded by non-conducting inclined planes."—*Franklin Institute Journal, Vol.* xvii, *3d series, p.* 320.

Charles Shepherd, London.—Improvements, April 16, 1849.—1st, The employment in chronometers, of apparatus actuated by electro-magnetism for winding up the remontoir escapement, which is retained by a detent.

2d, Giving audible signals in chronometers by means of a locking plate, and apparatus connected therewith, worked by electro-magnetism.

3d, An arrangement of apparatus for making and breaking the circuit.

4th, A peculiar arrangement and adaptation of apparatus, worked by electro-magnetism to chronometers.

5th, The combination in chronometers and telegraphs, of two pallets and detents for giving the step by step motion.—*Lond. Mech. Magazine, Oct.* 20, 1849.

L. G. Curtis, Ohio.—Improvement in Indicating Telegraph, January 16, 1849.—"The basis of the American Indicating Telegraph invented by me, is upon these principles, viz: Electro-Magnetism, machinery, figures and signs, and their combinations.

"This end is obtained by means of a revolving disk or dial plate, marked with successive series of numerals, 0 1 2 3 4, arranged in a circle or otherwise, said dial plate being revolved by degrees, as the galvanic current is completed and broken by the alternate vibration of the lever, to which the pallets, armature and springs are attached."—*Franklin Institute Journal, Vol.* xviii., *3d series, p.* 280.

Caleb Winegar, New York.—Improvement in Magnetic Telegraphs, March 20, 1849.—Claim· "moving the paper on which telegraphic marks are made, into and out of contact with a stationary pen, by which means I avoid the danger of dispersing the ink, which happens when the pen is rapidly agitated.

"I also claim operating the magnet which effects the movement of the paper.

"I also claim the arrangement for conveying ink to the stationary pen," &c., &c.—*Franklin Institute Journal, Vol.* xviii., *3d series, p.* 361.

M. Dugardin—Method of Insulating the Metallic Wires intended for Subterranean or Sub-marine Telegraph.—"This process consists of two operations. The first is the wrapping of ribbon of caoutchouc $\frac{4}{10}$ths of an inch wide, and $\frac{5}{100}$ of an inch thick, around a metallic wire, so that each turn of the wrapping shall cover about one-half of the preceding one. The second consists in wrapping spirally, and $\frac{4}{100}$ths thick, so that the edge of each turn shall touch the former, but without lapping over it. The leaden envelope serves to protect the caoutchouc from

blows, (Comptes de l'Academie des Sciences, for January 2d, 1849.)—*Franklin Institute Journal, Vol.* xvii., *3d series, p.* 284.

Henry G. Hall, Ohio.—Improvement in Posts for Telegraphs, &c., Sept. 19, 1848.—Preventing the posts from rolling, by combining the cast iron or artificial stone shoes with the posts.—*Franklin Institute Journal, Vol.* xxiii., *3d series, p.* 102.

To be Continued.

Translated for the Journal of the Franklin Institute.

Extract from a Report made by M. Ebelman, *to the French Society for the Encouragement of National Industry, on a new Combustible called "Charbon de Paris," (Paris Coal,) by* M. Popelin Ducarre.

M. Popelin Ducarre has submitted to the Society the product which he has been manufacturing for five years, and which is now well known to the public under the name of "Charbon de Paris."

The agglutinating agent which M. Popelin Ducarre uses is the tar from gas works, which is mixed with the fine debris of the combustible which is to be utilized. The mixture is strongly compressed and moulded in cylinders. The agglumerated charcoal is exposed to a second carbonization. The tar, decomposing, leaves a residuum of hard and brilliant charcoal, which forms throughout the combustible mass a kind of network, which holds together all the parts. The product thus obtained is but slightly friable, and may be carried to great distances without notable loss.

It may easily be conceived that the process of which we have thus given a very brief description, may be applied to any carbonaceous debris, whether they come from wood, coal, turf, or other combustibles. The same combustibles (except coal) cannot be utilized in the raw state, in consequence of the contraction which they undergo during carbonization, which prevents the charcoal from having any solidity.

Manufacture of the Paris Coal.—M. Popelin Ducarre has established the following arrangements in his establishment on the *Boulevard de l'Hôpital.*

The gas tar is received in a large cistern which will contain 400,000 kilos, (882,200 lbs. av.) It is raised by pumps, and led into reservoirs near the apparatus in which the mixture is to be made. The small coals are first ground under conical mills, then mixed with the tar under cylinders; 15 kilos, (33 lbs. av.,) are employed for one hectolitre, (26 galls.) of the powder, which weighs about 30 kilos, (66 lbs.) The mixture then passes into the moulding apparatus, which compresses it powerfully, and forms it into cylinders of about 0·1 net. (3·94 in.,) log. and 0·03 lbs. (1·18 in.) diameter. These cylinders are arranged in rectangular cast-iron cases carried on cars, which are by means of a railroad, run into the furnaces where the carbonization is to take place. These furnaces are of a very ingenious construction; their arrangement is such that the combustion of the products furnished by the distillation of the tar developes the heat necessary for the carbonization. M. Popelin Ducarre proposes to place at the end of these furnaces a steam boiler which shall utilize

the lost heat, and which will give him the 15 horse power necessary for the works of his establishment.

The Paris coal thus prepared ignites with considerable ease; it burns without flame or smoke, very slowly, and covering itself with a thick coat of ashes. A piece once well lighted continues to burn in the air, which distinguishes it strongly from coke; this slowness of combustion renders the Paris coal particularly useful for domestic purposes, especially for the working classes, and for small families, for certain uses in chemical laboratories, and for many uses in the arts for which a long continued and not too high heat is wanted. Its price is 15 to 16 francs per 100 kilos, ($30 to $40 per ton.) It contains a notable proportion of ashes, from 20 to 22 per cent. according to our analyses. The calorific value is, therefore, only about three-fourths of that of charcoal. This great proportion of cinders will probably injure its utility, in cases where a very high heat is required.

For the Journal of the Franklin Institute.

Launch of the Steamship State of Georgia.

On Thursday, 12th of February, the steamship *State of Georgia* was launched from the ship yard of Vaughn & Lynn. The following are her dimensions:

Length on deck,	205 feet.
Breadth of beam,	33 "
Depth of hold,	21 "

She is to be propelled by a single side lever engine, with a cylinder of 72 inches diameter, and 8 feet stroke, constructing by Merrick & Son, of the Southwark Foundry.

This ship is the first of a new line to be placed on the route from this City to Savannah, Georgia. Should the business warrant it, a second ship will be immediately put under contract. B.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, March 18, 1852.

James H. Cresson, President, P. T., in the chair.

John F. Frazer, Treasurer.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

A Letter was read from the Royal Institution, London.

Donations were received from the Royal Astronomical Society, London; The Akron Branch of the Cleveland & Pittsburg Company, Akron, Ohio; The Mercantile Library Association of St. Louis, Missouri; The Alton & Sangamon Railroad, Alton, Illinois; T. H. Forsyth, Esq., Senate of Pennsylvania; and Messrs. Lindsay & Blakiston, Prof. John F. Frazer, A. B. Hutton, Samuel Sloan, Dr. T. S. Kirkbride, Frederick Fraley,

Trustees Philadelphia Gas Works; and the American Philosophical Society, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of February.

The Board of Managers and Standing Committees reported their minutes.

The Board of Managers reported that they had organized, by electing Owen Evans, Esq., their Chairman, and appointing the second Wednesday evening of each month for holding their stated meeting.

The Standing Committees reported their organization, by electing their Chairman, and appointing the time for holding their stated meeting, as follows:—

On Meteorology,	Owen Evans, Chairman,	1st Monday	evening.
" The Library,	Dr. G. J. Ziegler, do	1st Tuesday	do
" Exhibitions,	Prof. J. C. Cresson, do	1st Thursday	do
" Cabinet of Models,	Chas. Welsh, do	do	do
" Minerals and Geological Specimens,	J. C. Trautwine, do	2d Monday	do
" Meetings,	Dr. B. H. Rand, do	do	do
" Science and the Arts,	Prof. J. C. Cresson, do	2d Thursday	do

On motion, the Committee on Exhibitions were instructed to take the necessary steps to hold an Exhibition of American Manufactures, next Fall, agreeably to their recommendation this evening.

New candidates for membership in the Institute (3) were proposed, and the candidates (21) proposed at the last meeting were duly elected.

Dr. Rand exhibited to the members a new form of cupping glass and artificial leech, the invention of Mr. Wm. L. Thomas, of New York. It consists of a cylinder of glass, having at its upper end a loose strong bag of caoutchouc; by means of a plunger this is extended so as to occupy the interior of the whole cylinder; upon the pressure being removed, a partial vacuum is produced, as is formed in the ordinary cupping glass by fire or the air pump. By alteration in the form or size of the tubes they may be employed on any part of the body. This apparatus is remarkable for its cheapness and simplicity.

Dr. Rand also exhibited a portion of the copper boiler of the U. S. Steamship Mississippi, showing the degree of corrosion it had undergone.

Mr. G. W. Smith exhibited a drawing of the new Cathedral of St. Peter and St. Paul, now in the process of construction in Logan Square.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on the Roofing of Dr. McDowell's Church.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, "The Cause of the Failure of the Roof of Dr. McDowell's Church," in Eleventh street, above Spring Garden, Philadelphia—REPORT:

That after a full examination of the fallen roof, and careful experiments with a model of the same, they have arrived at the conclusion that the

accident was owing partly to the employment of inferior timber, and partly to defective design.

The model of two trusses of the roof (of $\frac{1}{8}$th the full size) weighed *above* $5\frac{6}{10}$ lbs., and broke with a load of 516 pounds applied at its centre. The application of the weights was very gradual, occupying about a week; and the final load of 516 lbs. was borne for some hours before fracture took place. To this load at the centre, must be added one-half the weight of the model itself, (say 3 lbs.,) making in all 519 lbs. for the total breaking load, considered as applied at the centre.

Now, in applying the result of this experiment to the case before us, we have for our guidance, the fact sustained as well by theory as by experience, that in structures of this kind, (alike in every respect except size,) the strengths vary as the squares of their respective linear dimensions; while their weights vary as the cubes of the same dimensions.

Therefore, the strength of the actual roof, as deduced from that of the model, should have required for the breaking load of two of its trusses, *at the centre*, 64 times 519 pounds, or 33,216 pounds, and twice as much, or 66,432 pounds, if equally distributed over that portion of the roof supported by the two trusses.

Let us see by what weight equally distributed, the roof actually did break:—

The weight of the two actual trusses, as deduced from the model,—$5\frac{9}{10}$ lbs. (the weight of the model,) multiplied by 512, (the cube of 8,)	2867 lbs.
Weight of purlins deduced from those of the model,	1229
Tin roof, sheeting boards for ditto, lath and plaster, ceiling joists, &c.,	11,700
About 780 square feet of area, covered with saturated snow 7 inches deep, at 18 pounds per square foot,	14,040
Total,	29,836 lbs.

Or say 30,000 lbs.

From this we see that the roof broke down with a nearly equally distributed load not exceeding 30,000 pounds to each pair of trusses, instead of 66,432 lbs., as based upon the model experiment.

The Committee do not hesitate to ascribe this discrepancy chiefly to the difference between the timber of the model, and that of the roof itself; the latter having been found to contain many large knots and imperfections of grain, abundantly sufficient to lead to the want of correspondence.

The Committee therefore believe that had all the timber of the roof been as straight-grained and free from knots as that of the model, and the construction equally good in both cases, the roof might have stood for some years longer.

Independently however of the weakness produced by imperfections in the timber, the strength of the trusses was much below that required to ensure perfect safety.

To the securing of this end, a roof should always be so proportioned as to sustain at least three times its calculated breaking load; whereas in this instance we see that the actual breaking load was not quite one-half the calculated one. With a very heavy fall of snow the load would

have been much greater than at the time of the accident; which providentially occurred while the building was empty.

By order of the Committee,

William Hamilton, *Actuary.*

Philadelphia, March 11, 1852.

BIBLIOGRAPHICAL NOTICES.

The Microscopist; Or, A Complete Manual on the Use of the Microscope; for Physicians, Students, and all lovers of Natural Sciences. With illustrations. By Joseph Wythes, M. D. pp. 191. Philadelphia: Lindsay & Blakiston.

This manual is a very useful work, and one which was very much wanted by the lovers of Natural Science, as all the works containing the information in regard to the use of the Microscope and its numerous valuable applications are large and expensive; and it is somewhat surprising that the best work in the English language has not been reprinted in this country, namely, the work of Mr. John Quekett, Demonstrator of Minute Anatomy at the Royal College of Surgeons of England.

The Manual of Dr. Wythes, therefore, fills a void in our national literature, and is of so convenient a size as to be carried in the pocket, or used when manipulating with the Microscope. It is divided into fourteen chapters.

The first is devoted to an outline of the history and the importance of Microscopic Investigations. The second, third and fourth to a description of the Microscope, in its simple and compound form, with the most recent improvements, illustrated with numerous wood cuts, which cannot fail to make the instrument understood.

Chapters five to fourteen take up the subjects of procuring dissecting and mounting objects for the microscope, with a short notice of the uses of polarized light.

The subject of making preparations is then noticed, with the most recent improvements by Dr. Goadby, of England, and Dr. Goddard, of Philadelphia, which were noticed in a previous number of this Journal, and he concludes his volume by a series of miscellaneous hints to Microscopists, of great value.

Although the volume is a compilation, it is written with care and method, and contains just what the physician, the geologist, and the man of science wants, a practical and useful Manual of the Microscope.

T.

Templeton's Engineer, Millwright and Mechanics' Pocket Companion. Revised, &c. By Julius W. Adams, Civil Engineer, and just issued from the press of D. Appleton & Co., New York, is a useful resume of Tables and miscellaneous information adapted to the purposes of the mechanic, machinist, and engineer.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

MAY, 1852.

CIVIL ENGINEERING.

Extract from the Report to the Secretary of the Treasury, on Light-Houses of the United States.

Continued from page 238.

That the board respectfully recommend to the honorable Secretary of the Treasury, to direct that pending the future action of Congress on the subject of light-house improvements, the 7th section of the act making appropriations for light-houses, light-boats, buoys, &c., approved March 3d, 1851, in the following words:

Sec. 7. *And be it further enacted:* "That hereafter in all new light-houses, in all light-houses requiring new lighting apparatus, and in all light-houses as yet unsupplied with illuminating apparatus, the lens, or Fresnel system, shall be adopted, if in the opinion of the Secretary of the Treasury, the public interest will be subserved thereby," be strictly carried out, and that the necessary illuminating apparatus to fit up the light-houses now authorized to be built shall be of the lens system.

That a rigid and frequent inspection and superintendence by competent persons is essential to an efficient light-house establishment, and the board, therefore, recommend the appointment from the Army and Navy of a suitable number of inspectors for the lights and their accessories, throughout the United States.

That the present light-house establishment requires a thorough organization to ensure to the service, efficiency and economy, and therefore

the board recommend the organization of a light-house board, to be composed of Scientific Civilians, Army and Navy officers, to be charged, by law, with the entire management of the light-house establishment of the United States.

That all sea-coast and other 1st class lights should have not less than two keepers, including all 1st and 2d order lens lights.

That all constructions, renovations, and repairs of towers and buildings, be hereafter made upon the plans, estimates, and drawings, and under the personal superintendence of an officer of engineers of the Army, in conformity to the 9th section of the act making appropriations for light-houses, light-boats, buoys, &c.; approved March 3, 1851.

That the lanterns, and all apparatus for illumination, ventilation, &c., &c., be constructed under the personal superintendence of an officer of engineers of the Army.

That the sea-coast lights be increased in power and range.

That all light vessels not yet fitted with illuminating apparatus requiring to be renovated, and all that may hereafter be authorized by law, be fitted with the best system of lamps and parabolic reflectors, both for fixed and revolving lights.

That more attention be given to the subject of models for light-vessels, constructing and mooring them so as to give greater assurance to the navigator, that they will be always found in position.

That light vessels be painted and fitted with distinguishing marks by day, to enable the mariner to know them without difficulty.

That there be a uniformity in painting, marking, and distinguishing beacons; and that no one be allowed to change the color or distinguishing marks of any beacon, sea mark, or light-house, without authority from the proper office at Washington, and after ample notice shall have been given through the medium of the commercial papers of greatest circulation, and by placards distributed at the different custom-houses, both at home and abroad, and among consuls and commercial agents of maritime nations.

That the buoys be made in size to subserve their proposed purpose, and that different shapes be employed for different channels, dangers, &c., &c.

That competent professional men be required to make frequent inspections of the lights and other aids to navigation along the entire coast.

That supplies of all kinds undergo a most rigid test and scrutiny by a professional person of high moral and social standing, before issuing them to light-keepers.

That light-keepers undergo an examination before being placed in charge of any light, and that they be instructed by a competent person upon the detail of all the duties confided to them.

That instructions, rules, and regulations, embracing every point of duty, be drawn up in clear, plain, and explicit terms, suited to the capacities of the persons for whose benefit they are prepared, and distributed to the light-keepers and others connected with the service; that the general rules and regulations be printed in large type, with conspicuous headings, and framed, so that the keepers may always have access to them; and those more in detail to be well bound, and the keepers required to transfer them to their successors should they leave the lights.

That frequent and rigid inspections of lights by districts be made by competent professional men, and that they make regular returns to the head of the light-house department.

That the keepers be required to keep meteorological and tidal registers, in addition to the necessary returns of the daily consumption of oil and other supplies.

That no light-house keeper be appointed who cannot read and write, and is not in other respects competent to the faithful discharge of the duties.

That a mode of supplying persons employed at lights on rocks or other isolated points, on board of light vessels, &c., &c., with rations, to enable them to devote their entire time and attention to the duties, should be adopted.

That light-keepers be required to devote their entire time and attention to their duties on pain of dismissal, and in no case should a keeper be allowed to follow any other vocation to the neglect of the light.

That no keeper be allowed to be absent from the light without a positive written permission from the district inspector.

That no one but a regularly appointed keeper, and his assistant or assistants, be permitted to attend to the apparatus, lighting, &c., &c., of a light-house or light vessel.

That the best cleaning powders, rags, &c., trimming scissors, and other necessary articles for keeping good lights, be furnished to the keepers; and that they be instructed that, under no pretext, should they employ any other means for keeping their apparatus in good order than those pointed out in the printed instructions from the Department.

That proper curtains be provided for the apparatus of each light-house, &c.

That light vessels never be removed from their stations for repair without first placing a substitute; and in the event of a light vessel parting her moorings, then that position be occupied without delay by a substitute.

That proper lists for the supply of each class of light-house, according to order or number of lamps, be made, and the person charged with the delivery of supplies be guided by it alone, without any discretionary power to increase, lessen, or change the quantity of articles to be on hand on a certain day.

That all articles of supplies be selected and tested by persons of professional ability and standing.

That the necessary steps be taken, without delay, to ascertain what additional aids to navigation are necessary in the bays of New York, Delaware, and Chesapeake, and their tributaries, to enable steamers and other vessels to enter them at night, and proceed direct to their destination.

That hereafter, buoys, required to be placed over newly discovered shoals, or over vessels wrecked in or near channels, or where they may endanger vessels, be placed without delay, and the expense be defrayed from the general appropriations for buoys.

That larger and better distinguished buoys be placed to mark the

channels of our principal bays and harbors, especially New York bar and bay, Delaware and Chesapeake bays, &c.

That appropriations be asked for two first-class light vessels, to be fitted up in the best manner with the most approved reflector or refractor apparatus, and with proper distinguishing characteristics; one for the South shoals off Natucket, and the other for Frying-pan shoals, off Cape Fear, to be placed in the best positions for aiding navigators, under the direction of the Superintendent of the Coast Survey.

That appropriations be asked for renovating, and for first order lens apparatus for the lights at Cape Hatteras, North Carolina; Cape Florida, Florida; Dry Tortugas, Florida; Cape Canaveral, Florida; Cape Romain, South Carolina; Fire Island inlet, New York; Cape Henlopen, Delaware; Cape Henry, Virginia; Gay Head, Massachusetts; Montauk Point, New York; and for the following new lights, to be fitted with first order lenses, viz:

One, half way between Montauk Point and Fire Island light-house, Long Island; and one between Jupiter inlet and Gilbert's bar, Florida.

That the appropriation for Flynn's Knoll light-house be changed to authorize range beacons for New York harbor.

That an appropriation be asked for a bell-beacon for Flynn's Knoll.

That, as the foregoing recommendations can only be thoroughly carried out under the orders of a properly organized bureau or board, and as it is of vital importance to the interests of commerce and navigation, and of great importance in an economical point of view, that the present light-house establishment should be improved as rapidly as possible.

To carry out these suggestions, it is further recommended:

That a light-house board be created, by authority of law, to be attached to the Treasury Department, with power to provide rules and regulations for their meetings and proceedings, and for discharging, under the superintendence of the Secretary of the Treasury, all the duties appertaining to the management, maintenance, repair, renovation, illumination, inspection, superintendence, and construction of light-houses, light vessels, beacons, buoys, and their appendages, in the United States.

That the Secretary of the Treasury, as ex-officio president, with two officers of the Navy of high rank; one officer of the Corps of Engineers of the Army; one officer of the Corps of Topographical Engineers of the Army, and two civilians, of high scientific attainments, whose services may be at the disposal of the President, as members; and an officer of the Navy, and an officer of Engineers of the Army, as secretaries, shall constitute the light-house board of the United States.

That the light-house board be authorized to appoint their chairman, to preside during the absence of the president, and perform such other duties as may be required by their rules and regulations.

That the light-house board be authorized to prepare such rules and regulations as shall be necessary for securing an efficient, uniform, and economical system of light-house administration, and for securing responsibility in the inspectors, keepers, and others connected with the light-house service, subject to the approval of the Secretary of the Treasury, and which, when approved, shall be respected and obeyed, until altered or revoked by the same authority.

That the light-house board be required to meet four times a year, and subject to be convened by the Secretary of the Treasury, whenever, in his judgment, it may be necessary for the transaction of general or special business, a majority of whom shall constitute a quorum.

That such clerks as are now employed on light-house duties in the Treasury Department may be transferred to the light-house board without any increase of salaries; that the necessary accommodations for the clerks, secretaries, for the preservation of the archives, drawings, &c., &c., and for holding the meetings of the board, be provided in the Treasury Department.

That all archives, books, drawings, models, &c., &c., belonging to the light-house establishment, may be transferred to the light-house board, for their use, in the discharge of their duties.

That the President be authorized and required to appoint from the Army or Navy an inspector of lights, beacons, buoys, &c., for each light-house district, to be arranged by the board, with the approval of the Secretary of the Treasury; which inspectors shall be under the orders of the light-house board.

That the light-house board be authorized to prepare and distribute among the light-house keepers, inspectors, and others connected with the light-house establishment, such rules, regulations, and instructions, as may be necessary to secure an efficient, uniform, and economical system of administering the light-house establishment of the United States, and to secure responsibility from them.

That the light-house board be authorized and required to cause to be prepared by the engineer secretary of the Board, or by such officer of engineers of the Army, as may be detailed for that service, all plans, drawings, specifications, and estimates of cost, of all illuminating, and other apparatus, and of construction and repair of towers and buildings, &c., &c., connected with the light-house establishment; no bids or contract being accepted or entered into, except upon the decision of the Board, at a regular or special meeting, and through their properly authorized officer.

That, hereafter, all materials for the construction and repair of light-houses, light-vessels, beacons, buoys, &c., &c., shall be procured by public contracts, under such regulations as the Board may from time to time adopt, subject to the approval of the Secretary of the Treasury, and all works of construction, renovation, and repair, shall be made by the orders of the Board, under the immediate superintendence of their Engineer secretary, or of such Engineer of the Army as may be detailed for that service.

That it shall be the duty of the Light-house Board to furnish, upon the requisition of the Secretary of the Treasury, all the estimates of expense which the several branches of the light-house service may require, and such other information as may be required, to be laid before Congress at the commencement of each session.

That all acts and parts of acts, inconsistent with these recommendations, be repealed; and all acts and parts of acts relating to the light-house establishment of the United States, not inconsistent with these recommendations, and necessary to enable the light-house board, under the super-

intendence of the Secretary of the Treasury, to perform all duties relating to the management, construction, illumination, inspection, and superintendence of light-houses, light-vessels, beacons, buoys, sea-marks, and their accessories, including the procuring and testing of apparatus, supplies, and materials of all kinds for illuminating, building, and rebuilding when necessary, maintaining, and keeping in good repair the light-houses, light-vessels, buoys, beacons, and sea-marks of the United States; and the second and third sections of the act making appropriations for light-houses, light-vessels, beacons, buoys, &c., approved March 3, 1851, be declared to be in full force, and have the same effect as though the light-house Board had not been created.

That no additional salary be allowed to any civil, military, or naval officer who shall be employed on the light-house board, or who may be in any manner attached to the light-house service of the United States; and that it shall be unlawful for any member of the light-house board, inspector, light-keeper, or other person in any manner connected with the light-house service, to be engaged, either directly or indirectly, in any contract for labor, materials, or supplies for the light-house service, or to possess, either as principal or agent, any pecuniary interest in any patent, plan, or mode of construction or illumination, or in any article of supply for the light-house service.

With such a board for the care and management of our present large and daily increasing light-house establishment, composed of the best adapted materials, from civil, military, and naval life, our lights must not only rapidly improve in efficiency, but also in economy.

By the assistance of the officers, proposed as inspectors, and the two secretaries of the Board, a general and systematic plan of classification, distinction, illumination, construction, repair, inspection, and superintendence, will, in a short time, be introduced, to the great advantage of commerce and navigation, and to the economy of the service.

The engineer secretary, with the assistance of officers of engineers now authorized by law to superintend the construction and renovation of light-houses, &c., will be able to prepare plans, estimates, and specifications of proposed works of construction and repair, and give a general superintendence to the lights, beacons, and buoys along the entire coast. The board will be able, at the close of the first fiscal year after it is in operation, to make detailed returns of expense of apparatus, combustibles, &c., &c., exhibiting at one view the actual annual expense of every light on the entire coast; examine into the best modes of construction for special positions, make necessary experiments upon apparatus, oils, gases, &c., &c., for light house purposes; and determine, from information derived from their own and other competent officers, what increased aids are necessary along the coast to recommend to Congress.

They would in a short time be able to furnish to navigators clear and full descriptive lists of the lights, beacons, buoys, sea-marks, &c., with such notices of them as may be necessary to guide them in making our coast in tempestuous weather, and which could be reprinted at short intervals of time, if necessary, to point out new structures or changes.

The Coast Survey Charts would then be furnished with an account of every change of position or character of lights, buoys, beacons, &c.,

&c., which would enhance their present great value to the navigating community.

Under an efficient organization, such as the proposed, the duty would be performed better and more economically than at present, and there would be great saving in the end, by affording to Congress estimates for proposed new works, rejecting works not considered necessary, and by introducing a class of structures which would require much less annual expense for repair than those now existing.

The ablest engineers of the Army would be called upon to decide upon plans for structures in cases involving doubts; the best and most durable illuminating apparatus would either be imported or fabricated in this country under the immediate eye of the officers of the Board, and when ready, be placed properly in the lanterns by the engineer charged with the work.

Boards for the execution of important duties are not novelties even in this country. Some, and indeed nearly all, of the most important undertakings which this Government has ever embarked in, have been planned and executed under the general supervision and management of boards.

They are found in nearly every branch of our civil and military institutions; of every name, and for almost every purpose. They have been successfully tried for this special purpose in France, where the Savans of the Academy of Sciences, without fee or reward, sit side by side with the Minister of State, the officer of the Navy, and the Engineer; in England, the Duke of Wellington presides, while the Prince, the Peer, the Admiral, the Commoner, and the retired Sea Captain, sit together and devise means for alleviating the hardships and lessening the dangers of the mariner in approaching their dangerous coast.

In Scotland this important branch of service is under the management of a board composed of the Sheriffs of the counties, lawyers, and other civilians, who meet four times a year, without any remuneration, to transact business connected with the lights of Scotland.

In addition to these meetings, there are numerous standing committees; some of which meet as often as once a fortnight for the transaction of business, which is reported to the general meetings for their sanction and approval. There is attached to this board a secretary and an engineer, who is the executive officer, upon whom devolves all the scientific details of construction, repairs, and illumination.

In Ireland there is also a board charged with the management of light-houses, &c., with a secretary, engineer, &c.

This board, as in Scotland, is composed chiefly of philanthropic Civilians and an English Admiral. The fact of Scotland and Ireland having no army or navy, and no distinct commercial marine, will readily account for such an organization, in which no motive, other than the praiseworthy one of doing good, could prompt individuals of standing, wealth, and distinction, to perform the drudgery of so laborious an office without pecuniary remuneration.

There is not a harbor in England, of any note, that has not its "Trinity Board," or "Board of Trustees," charged with the lights, beacons, and buoys; such, for example, as Liverpool, Newcastle-upon-Tyne, Hull, &c., &c., under all of which the lights are managed in a manner worthy

of the highest commendation, both for efficiency and economy. (Vide letter of Wm. Lord, Esq., Surveyor of the Port of Liverpool, and returns of local corporations, appendix.)

It is thus seen that the best managed lights of Europe are under the management and direction of boards, with proper officers to assist them in their duties. That this service should be deemed sufficiently honorable in France, Scotland, &c., to be performed gratuitously, is not so much to be wondered at, when we recollect the high standard of excellence it has reached through the instrumentality of the philanthropic individuals constituting those light-house boards.

In concluding this part of their report, the board consider it their duty to urge upon Congress the necessity for a change in the present management of our light-house establishment.

In investigating the subjects confided to them, they have endeavored to reach the truth from observation and research. That they have not done injustice to any one, they feel perfectly conscious; to have passed over palpable defects in the present management of our lights, involving great loss of human life and property, without pointing them out, would have been culpable and unpardonable; and that they have looked as leniently as possible on many points considered exceptionable, it is believed will be clearly shown by their report.

The board have not sought so much to discover defects and point them out, as to show the necessity for a better system. Commerce and navigation, in which every citizen of this nation is interested, either directly or indirectly, claim it; the weather-beaten sailor asks it, and humanity demands it.

On the Alluvial Formations and the Local Changes of the South-Eastern Coast of England. First Section, from the River Thames to Beachy Head. By J. B. REDMAN.*

The paper stated, that the passage of shingle along the English coast, due, as was generally believed, to the action of waves alone, took on the south coast a course from west to east, and on the east a course from north to south; during certain winds the shingle was heaped up coincident with their direction, and repeated withdrawals and renewals (the latter being the most frequent) caused a leeward movement of the material, forming it, at the same time, into a series of triangles, of which the shore was the base. If any natural or artificial projection interrupted this motion, an accumulation, which would increase and be held in check according to the state of the wind, took place up to a certain point, or until the angle formed was filled up, when the shingle would pass round. With groynes, by far the most common action was, unless they were of great height, or short length, for the shingle, after accumulating on the weather side to the level of the top of the groyne, to pass over it, and then travel to leeward.

The degradation of the north shore of Kent, the local formation of shingle around the Isle of Thanet, by the wasting away of that chalky

* From the London Athenæum, December, 1851.

promontory, and the retention of large masses of alluvial matter in Pegwell Bay, were dwelt on. The main belt of shingle lying to the south of Deal, and extending from thence to Dover, with its early and present effects on the harbor at the latter place, were then described; also, the early condition of Folkstone Harbor, the large accumulation of shingle arrested to the westward of that haven, by the projection of a low-water pier, or groyne, at right angles to the harbor, and its effect upon the shore to the eastward, by retarding the progressive motion of the shingle in that direction. Further on, the curious formation at Dungeness Point, which it was reasonable to suppose did not at one time exist, as the parallel "fulls" of beach between Romney and Lydd, and extending from Winchelsea on the west to Hythe on the east, seemed formerly to have constituted the sea coast. The rectangular "full," running from the banks on the west side of Lydd towards the point, might have been created by an accumulation of shingle traveling from the westward, held in check by the outfall of the river Rother; the angle contained by this spit and the coast to the westward becoming gradually filled up with shingle, a silty deposit would take place on the east side, consequent on the gradual loss of Romney Harbor, and the length of the spit would be increased by the parallel ridges of shingle periodically added to, and traveling round it. Numerous examples, extending over two centuries, showed that the average annual increase was six yards, reaching, over certain periods, an average of eight yards per annum, the absolute increase since the time of Elizabeth being nearly one mile; and they proved conclusively, that the average progress seaward, producing a determinate aggregate elongation in a south-easterly direction, was much greater than had been generally assumed, though not regular, for the Ness had even been stationary during certain periods.

The gradual decadence of the ancient ports of Hythe, Romney, and Lydd, to leeward of this Point, was then alluded to; as also, the diversion of the outfall of the river Rother to Rye, once an estuary of the sea, and then forming Romney Harbor; the great increase of shingle to the westward; the early and abortive attempts to form a harbor at Hastings; the vast abrasion of the coast along Pevensey Bay, the harbor of which place had been lost by the elongation and extension of Langley Point. Between the origin of this Point and that of Dungeness, there was a remarkable similarity, both having originally had a tidal haven to the leeward, eventually choked up by the elongation of these spits across their outfalls; both had pools, or meres, arising from the land-locked waters, and in both cases the modern "fulls" of shingle could be plainly distinguished from the more ancient, by their forms and direction. The remarkable decrease of this point, about three-eighths of a mile, during the last century, appeared to arise principally from Old Brighton Beach no longer affording the necessary supply of shingle.

The early condition and present state of Cuckmere and Newhaven Harbors, the great degradation of the coast at Rottingdean, the sweeping away during Elizabeth's reign of the beach and town of Old Brighton, then standing on the site of the present Chain-pier, the materials from which formed the spits to the eastward, were described.—*Proc. Inst. Civ. Eng.*, *December*, 1851.

AMERICAN PATENTS.

List of American Patents which issued from March 2d to March 30th, 1852, (inclusive,) with Exemplifications by CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Life Preservers;* Stephen Albro, Buffalo, New York, March 2.

Claim.—"I claim as my invention the sectional berth-bottoms, as represented by figs. 2 and 3, and as minutely described,"

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2. For an *Improved Arrangement of Steam Boilers;* William Barnhill, Pittsburg, Pennsylvania, March 2.

Claim.—"I am aware that it is not new to locate a cylindrical water vessel in the flue of a boiler; and also, that such vessel sometimes contained flues; but these flues were in this instance direct flues, and the fire box was placed outside of the boiler proper.

"What I claim, therefore, as my invention is, the arrangement of the cylindrical boiler having return flues therein, within the flue of the main boiler, in such manner that the front end of said cylindrical vessel extends over the fire grates, and so that nearly its whole outer surface is exposed to the action of the flames, gases, &c., which, after their passage through the annular flue, proceeds to the chimney, through the small flues in such cylindrical vessel."

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3. For an *Improvement in Grain Dryers;* Henry G. Bulkley, Kalamazoo, Michigan, March 2.

"The nature of my invention consists in constructing a cheap apparatus, to make so much steam only as is necessary to keep the materials to be kiln-dried from scorching, and in using the escape heat to keep up the temperature of the steam thus made for kiln-drying rapidly."

Claim.—"What I claim as my invention is, so arranging an open steam or pan, in connexion with the fire chamber and steam chamber, and flues for the escape of heat, that the steam shall rise freely into the steam chamber, and the heat kept up by contact with the escape flues, as herein described, for the purpose of producing a high degree of heat, yet not so high as to injure the grain or other materials to be dried by its agency."

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4. For *Improvements in Omnibus Registers;* F. O. Deschamps, Philadelphia, Pennsylvania, March 2.

Claim.—"What I claim as my invention is, the use of the ratchet wheel, E, and its pawl, or their equivalents, for the purpose, substantially as herein set forth, of preventing the possibility of giving a blow to the hammer, by means of a recoil of the wheel, B.

"I also claim the combination, substantially as herein described, of the toothed wheel, G, to which the dial plate, A^2, is affixed, with the notched cylinder, I, and click, H, whereby the dial plate, A^1, for registering the concealed dial plate, A^2, 24, or any number of fares marked on the dial plates, A and A^1, substantially as herein set forth."

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5. For an *Improvement in Chairs;* George O. Donnell, New London, New York, March 2.

"The nature of my invention consists in a metallic ferrule, ball, and foot piece, combined and applied to the back posts of a chair, in such a manner as to let the chair take its natural motion of rocking backwards and forwards, while the metallic foot piece rests unmoved, flat, and square, on the floor or carpet."

Claim.—"What I claim as my invention is, the construction and application of a metallic combination to the lock posts of chairs, so as to let the chairs take their natural motion of rocking backwards and forwards, while the metallic feet rest unmoved, flat and square, on the floor or carpet, or any other metallic affixion substantially the same, and which will produce the intended motion."

6. For an *Improvement in Cast Iron Car Wheels;* Orson Moulton, Blackstone, Massachusetts, March 2.

"This invention consists in connecting the hub and rim by two curved plates, having raised or projecting ribs running in cyma form on their inner sides, from the hub to the rim, and across the inside of the rim, the ribs on each side being placed opposite the middle of the space between those on the opposite side."

Claim.—"What I claim as my invention is, connecting the hub and rim of railroad wheels by curved parts, A A, having raised or projecting ribs, *a a*, and *b b*, of cyma form, on their inner sides, extending also across the inside of the rim, the said rims on each plate being placed opposite the middle of the spaces between those on the opposite plate, and each rib terminating in the opposite plate to that on which it stands."

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7. For *Improvements in Knitting Looms;* William Henson, Newark, New Jersey, March 2.

Claim.—"Having now described the construction and operation of my improved knitting loom, I disclaim the invention of warp machines; also, the invention of needles, guides, sinkers, presser and actuating cams, or cut wheels, for racking the guide bar, the same having been used prior to my invention.

"But what I do claim is, 1st, the relative motions of the needles, hooks, and presser, as combined, to form the looped or knitted fabric, in combination with the stops or guards on the hook bar, to prevent the presser from coming in contact with the hooks; the whole being constructed and arranged substantially as herein set forth.

"2d, I claim the combination of mechanism for regulating the take-up motion according to the quantity of fabric formed, without varying the tension of the fabric, substantially as described."

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8. For an *Improvement in Cotton Presses;* Lewis Lewis, Vicskburg, Mississippi, March 2.

Claim.—"What I claim as my invention is, the arrangement herein described, of a vertical revolving press, with toggle joint, operated by the toothed racks and fixed pinions, substantially as herein set forth."

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9. For *Improvements in the Plates of Trunk Locks;* Conrad Liebrich, Philadelphia, Pennsylvania, March 2.

Claim.—"Having thus described the nature of my invention and the manner in which it is constructed, what I claim as new is, the guard constructed and applied as described, by which the lock is prevented from being wrenched or torn off from the article to which it is attached, and by which the hasp is prevented from being pryed or twisted, so as to be freed from the bolt; thus obviating the necessity of the ordinary back plate, substantially as set forth."

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10. For an *Improvement in Blasting Rocks under Water;* Benjamin Maillefert, City of New York, March 2.

Claim.—"What I claim as my invention or discovery is, the blasting of rocks under water, by placing the explosive charge or charges on or against the surface of the rock to be blasted, and using the surrounding water as the means of resistance to the explosion, substantially as herein specified."

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11. For *Improvements in Cast Iron Car Wheels;* Hiram W. Moore, Bridgeport, Connecticut, March 2.

"The nature and object of my invention and improvement consists in constructing cast iron car wheels for railroad cars, in such a manner and form as to prevent their fracture and cracking, by the unequal contraction of the metal composing them, while consolidating at the time of their manufacture; the unequal shrinking of the different parts being the greatest difficulty to overcome in casting perfect wheels."

Claim.—"What I claim as my improvement in railroad car wheels is, the concave rings formed and located as described, in combination with the spokes or braces in the

exterior ring, and the concavo-convex plate or partition, arranged and combined substantially as herein set forth."

12. For an *Improvement in Machines for Printing Floor Cloths;* Simeon Savage, Lowell, Massachusetts, March 2.

Claim.—"What I claim as my invention is, the arrangement of the printing mechanism, the stamping down mechanism, and the mechanism for advancing the piece or strip of cloth or of material to be printed and pressed, or stamped; such arrangement being as exhibited in the drawings and as above described.

"And I also claim the combination of the lip bar or plate, *y*, the series of bent levers, *a′ a′*, &c., the slide bar. R′ or S, and the bar, *c′*, as made and operated substantially in manner and for the purpose of seizing the selvedge edge of the cloth, and moving the piece as described.

"And I also claim the combination of mechanism for operating the coloring carriage, or imparting to it its back and forth movements and necessary intervals of rest; the said combination consisting of the rotating shaft, O, with its circular disks, Q R, and their projections, *i k*, the four hook bars, *l l p p*, together with the vibrating bars, *n o*, as applied together and operated substantially as specified."

13. For an *Improvement in Endless Chain Horse Powers;* Theodore Sharp, Albany, New York, March 2.

"The nature of my invention consists in constructing the endless chain of curved links, with teeth on the outer edge, which give motion to pinions at or over the one end, the said curved links, on their inner edge, fitting on and corresponding with the peripheries of drums or pullies, at either end, so that the carrying rollers are allowed to move in space, while traveling the ends where a change of motion occurs, and much friction is necessarily avoided."

Claim.—"Having thus described my invention, I do not claim constructing the endless chains of horse powers, with curved or bent links, the under surface of which corresponds to the surface of the revolving drums which support them, as that has been done before; but what I do claim as my invention is, the combination of the bent links *a a*, the revolving drums B, and the pinions D, constructed and operating in the manner and for the purpose substantially as described."

14. For an *Improvement in Bridging Navigable Streams;* Benjamin F. Lee, City of New York, March 2.

"The nature of my invention consists in a new combination of bridge, canal, tunnel, and road, by means of which, neither the passage of carriages, or cars, across rivers, nor the passage of vessels up and down them, is impeded for an instant, draw bridges by this invention being rendered unnecessary."

Claim.—"What I claim as my invention is, the combination of canal A, tunnel B, bridge and road, constructed and arranged substantially as above described."

15. For an *Improvement in Friction Clutches;* Gerard Sickels, Brooklyn, New York, March 2.

Claim.—"What I claim as new is, 1st, the arrangement of the levers C, and arms $d\ d^1$, for operating the segments E, E, substantially as shown and described, by which arrangement the segments are made to bind in the V collar F, or be relieved from it, as desired; the segments, when bound in the collar, remaining in that state, the points or pivots *e e*, having passed the line of pressure, unless acted upon by some extraneous force, as the moving of the vibrating slide G.

"2d, I claim, in combination with the arrangement of levers and arms, the V collar E, and segments E E, said segments being adjusted by screw rods *h*, and nuts *i*, as set forth."

16. For an *Improved Encircling Suspender for Garments;* Harris H. Tinker, New London, Connecticut, March 2.

Claim.—"What I claim as my invention is, the combination of the spring or belt, *a*,

with the straps, *h k*, and the circular pads, *k*, fig. 7, for the purpose of sustaining garments upon the human body, arranged substantially as set forth in the above specification."

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17. For an *Improvement in Brick Machines;* Samuel L. Speissegger, Savannah, Georgia, March 2.

Claim.—"What I claim as my invention is, the employment of the plate, L, of the traveling mould table, operating simultaneously on the rods, *d d*, and pistons, c c, in the moulds, *b b*, in combination with the pressing plate, N, of a steam or other press, for the formation and delivery of brick, as substantially set forth."

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18. For an *Improvement in Camphine Lamps;* Isaac Van Bunschoten, City of New York, March 2.

Claim.—"I am aware that a lamp has been made with a flanch or short pipe inside the wick tube, to enter inside the air tube, to prevent the resinous matter formed in burning, sticking the wick and air tube together; but I am not aware of packing ever having been employed at this point. Therefore, what I claim is, 1st, the application of a suitable elastic packing between the wick tube, and air tube, attached in any convenient manner, in camphine lamps, for the purposes and as described and shown.

"2d, I claim the application of a suitable ring or chamber around the wick tube, to receive or conduct water or other fluid to the wick, so that the light is extinguished in case of accident, as described and shown."

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19. For an *Improvement in Compasses for Determining Variation from Local Causes;* John R. St. John, City of New York, Assignor to the St. John's Compass and Log Company, March 2; patented in England, December 27, 1851.

Claim.—"I do not claim the invention of a new mariner's or surveyor's compass, because these improvements can, in most instances, be added to compasses already in use; but I do claim as new and of my own discovery, or invention and improvements, the application of satellite or auxiliary needles to the magnetic compass, such needles being prepared, applied, and adjusted in the manner and for the purposes as herein set forth, including any merely mechanical variations that shall be actual equivalents of the means employed, as described and shown herein, and substantially the same as applied by me for the purposes herein set forth."

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20. For *Improvements in Flour Bolts;* Samuel Cook, Adams' Basin, New York, March 9.

"The nature of my invention consists in so arranging a bolting machine, as that it shall perform all the functions of cooling, bolting, and bran-dusting, in one continuous operation, and thus avoid the necessity of three distinct and separate machines, and merely occupy the space usually allotted to the most compact bolting machines."

Claim.—"Having thus fully described my invention, what I claim therein as new is, in combination with a series of graduated stationary bolting disks in separate chambers, the rotating brushes placed above said disks, and the sweeps in a chamber below them, for the purpose of separating the bran, first and second middlings, and the flour, and conveying the meal, &c., through the machine, and for avoiding the use of a bran duster; the whole being arranged in the manner and for the purpose herein fully set forth."

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21. For an *Improvement in the Water Gauge of Boilers, &c.;* Benjamin Crawford, Allegheny City, Pennsylvania, March 9.

Claim.—"What I claim as my invention is, the arrangement of the glass index tube, below the point at which the float chamber is connected with the water in the boiler, the water tube connecting with the boiler, at some distance from the bottom of the latter, so that it is not liable to become obstructed, which renders the indications of the float certain, while the coolness and quietness of the water in the index tube leaves it transparent, so that the index can be seen clearly and conspicuously."

22. For an *Improvement in Corn Shellers;* William Linsley, Township of Waddam, Illinois, March 9.

"The object of my invention is to shell ears of corn of varying size and shape; and it consists of stationary sectional spring shelling plates, with a rotating sectional spring shelling disk; the two acting in such manner that they yield to thick ears of corn, or to the thick part of an ear, and thus shell off the grain, without breaking up the cob, while they close upon small ears, or upon the small end of a thick ear, and insure the separation of the grain from the cob, whatever may be its size and proportions."

Claim.—"What I claim as my invention is, the combination of stationary sectional spring shelling plates, with a rotating sectional spring shelling disk, substantially in the manner herein set forth, the plates and disks having a wabbling or universal motion, caused by the constant varying of the space between them, to accommodate itself at the same time to ears of varying size and shape, by which means the cobs are less broken and more thoroughly stripped than in machines as heretofore constructed, for shelling corn fed into them promiscuously and in mass."

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23. For *Improvements in Canal Lock Gates;* Charles Neer, Troy, New York, March 9.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, 1st, The opening of the lower gates of a canal or river lock outwards or down stre m, in combination with the means described, or their equivalents, for operating them, for the double purpose of saving length in the lock chamber with the same walls, and for allowing the gates to be opened before the chamber is entirely empty, so that the escaping water may carry out with it the boat, raft, or other thing, being passed through with the least possible delay.

"2d, I claim the stationary gate at the head of the lock which forms, with the breast wall of the lock, with the top of which it is level, a recess or chamber, through which the lock chamber may be filled at any desired height above the bottom of the lock, and thus save length of lock wall.

"3d, I claim, in combination with the stationary gate, the sinking head gate, extending across the lock, and reaching down a little below the top of the stationary gate, when the gate is shut, and which sinks or slides into the recess formed in part by said stationary gate, and is on a level therewith, when open, for passing boats, &c., for the purpose of saving in the length of the lock chamber, an amount nearly equal to the width of the gate.

"4th, I claim the so placing of an adjustable bottom or water strip on the bottom of a lock, as that it may be operated upon by the pressure of the water within the lock chamber, and be forced up against the gate, when prevented from being closed tight by an intervening substance, substantially in the manner herein set forth and described."

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24. For an *Improvement in Seed Planters;* Ira Reynolds, Republic, Ohio, March 9.

"The nature of my invention consists in a peculiar form of grain cylinder and box, for conducting the grain into the teeth of the machine; also, the arrangement of a multiplying wheel or hub upon each end of the axle tree, for regulating the quantity of grain desired to be sown; also, the general arrangement of the several parts, to effect these ends."

Claim.—"I am aware, however, that driving wheels have been attached to the ends of the axle tree, for the purpose of driving grain cylinders, and do not wish or intend to claim as new the arrangement of driving wheels, abstractly considered, on each or either end of the axle tree, as mere driving wheels. But what I do claim as my invention is, the peculiarly formed curved lips or feeders, and longitudinal grooves or channels, so constructed and tightly fitted to the cast box, L, as to prevent any grain from passing into the chamber, except what is forced through the grooves by the lips or feeders, substantially as set forth."

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25. For an *Improvement in Hay Rakes;* Jay S. Sturges, Litchfield, Ohio, March 9.

Claim.—"I disclaim suspending the head, so that each tooth acts separately, and the platform, L. What I claim as my improvement is, 1st, The arms projecting from the axle, in combination with the joint, F, for the purpose of adjusting the position of the teeth to the surface of rough or smooth land.

"2d, Hanging the arms to the axle by means of the standard, I, and connecting rod, and also raising and lowering the arms as the teeth may require, by means of the pin and holes in the connecting rod and arms at J."

26. For an *Improvement in Melodeons;* A. L. Swan, Cherry Valley, New York, March 9.

Claim.—"What I now claim as my invention is, 1st, constructing the air receiving box of a melodeon, or other keyed wind instrument of a similar nature, which is operated by an exhausting bellows or pump, with a vibrating or movable top, connected to it by wings or joints, which fold or bend, substantially in the manner described, towards the external air which acts upon them, whereby the external air, acting upon the said wings, counteracts the inequality of the force exerted by the spring placed inside, to open or expand and enlarge the interior capacity of the box.

"2d, The manner of hanging the treadle, L, for operating the bellows, upon the two vibrating rods, M and M, attached to the floor, or to any object under the instrument, substantially as herein set forth."

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27. For an *Improvement in Iron Fences;* John B. Wickersham, City of New York, March 9.

"The nature of my invention consists in so forming the mortises and loops upon the posts and rails of iron or other metallic fences, and the putting of the same together, as that they shall form a solid, firm fence, without the use of keys, bolts, wedges, or any other fastenings than those afforded by the shapes of said mortises and loops, and using for this purpose but single posts in each panel thereof."

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, so constructing the loops and mortises in the rails and posts of iron fences, as that when in place neither of them can be removed, using for this purpose single posts and rails, and neither bolts, wedges, keys, or any other fastening, except what is afforded by the peculiar shape of the said loops and mortises; and this I claim, whether the same be constructed as herein described, or by any other means essentially the same."

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28. For an *Improvement in Ploughs;* Joshua Woodward, Haverhill, New Hampshire, March 9.

Claim.—"Having thus fully described my weeding plough, what I claim therein as new is, the plate constructed, arranged, and combined with the plough, substantially in the manner and for the purpose set forth."

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29. For an *Improvement in the Manufacture of Door Knobs;* Benjamin Nott, Bethlehem, Assignor to John P. Pepper, Albany, New York, March 9.

Claim.—"I claim, substantially as set forth in the above specification, in the manufacture of vitreous metal knobs and similar articles, 1st, The application and use of a metal plug, to be entered into the socket and fitting it, ~~the~~ plug passing up from or through the bottom of the mould, for the purpose of preventing the melted material from filling the socket during the pressing operations, and at the same time facilitating the centreing and adjustment of the socket.

"2d, I claim the invention of, and substitution in the place of pincers and polishing rods heretofore known, a polishing rod capable of polishing several knobs simultaneously and by one operation, substantially as above described."

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30. For *Improvements in Double Plane Irons;* Fordyce Beals, Pittsfield, Massachusetts, March 16.

Claim.—"I disclaim all contrivances, arrangements, or forms of cap or iron, which together compose a double iron, now in general use. What I claim as my invention is, the new and improved mode of fastening and adjusting the cap to the iron, by means of a projection and slot, forming a dove-tail slide, giving new facilities for the operation, and also a level surface to the back of the iron; also, the elongation of part of the width of the cap, and its occupying the place of a removed part of iron, giving the operator new facilities in nicely adjusting cap to edge of iron, without removing it from the stock, the same as herein described, using for the purpose the aforesaid arrangements of parts, or any other substantially the same, and which will produce the same effect in like manner."

31. For an *Improved Pressure Gauge;* Benjamin Crawford, Allegheny City, Pennsylvania, March 16.

Claim.—"What I claim as my invention is, a closed pressure gauge, constructed substantially as herein described, so that equal increments of pressure will cause the indicating liquid to rise in the tube equal linear distances, or thereabouts, in combination with an adjustable scale to indicate the degree of pressure, and a standard weight and blow-off valve, by which the scale can, from time to time, be adjusted, so as to give true indications of the pressure of the steam, substantially as herein set forth."

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32. For an *Improvement in Carpets;* Thomas Crossley, Roxbury, Massachusetts, March 16.

Claim.—"I lay no claim to the invention of making a carpet by the process of plying and ingraining, or connecting together, the plys or different layers of cloth, whether woven either with plain (or uncolored) or colored yarns; nor do I claim the process of producing figures by printing them in colors; nor do I claim to weave a carpet with an uncolored pile or warp in the Brussels process of weaving, and afterwards printing the figures thereon in colors: but what I do claim as my invention, or new or improved manufacture, is, an ingrained, plyed printed carpet, made by a combination of the process of weaving in two or more plys, and ingraining the same, and subsequently printing the figure or figures on both sides of the same, as described; the discovery having been made by me, that the plying process prevents the colors printed on one ply from penetrating the other ply, so as practically to injure its other surface, to an extent which renders it unfit for the reception of colors and use as a carpet, as herein before stated, a great improvement in trade being the result of such."

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33. For an *Improvement in the Construction of Grate Bars;* Frederick P. Dimpfel, Philadelphia, Pennsylvania, March 16.

"The nature of my invention consists in constructing grate bars for furnaces of clay, soapstone, or other refractory substance, enclosed in a metallic casing, or sustained by a metallic frame, when such is required."

Claim.—"I am aware that grate bars have been, heretofore, so constructed of metal, that the loose ashes of the furnace might accumulate in cavities therein, and protect the bar; but these have been found inefficient in practice, as any loose substance merely accumulating in the cavity of a metallic grate bar, will shake off even with the edges thereof, and thus expose the bar to the action of the fire. I do not, therefore, wish to be understood to claim any particular form of grate bar, the above described frame being one of easy construction and adaptation to the purpose; but any other suitable form may be given to this frame, which the nature of the refractory substance may render preferable. What I claim as my invention is, the construction of grate bars for furnaces of clay, soapstone, or other refractory substance, for the purpose and in the manner herein specified."

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34. For an *Improvement in Sofa Bedsteads;* John T. Hammitt, Philadelphia, Pennsylvania, March 16.

"My improvements are comprised in the combination of certain conveniences for the toilet and other purposes, necessary to a bed-chamber, all contained within the dimensions of a sofa when put up, and yet to be easily drawn out and arranged for service."

Claim.—"Having thus fully described my improved sofa bedstead, what I claim therein as new is, 1st, the combining the back of the sofa with the seat, by means of sliding pivots, in the manner and for the purpose set forth.

"I also claim the sliding table and wash-stand, in combination with the sofa, substantially in the manner and for the purpose set forth."

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35. For an *Improvement in Joints around Tubes for Philosophical Apparatus;* A. B. Latta, Cincinnati, March 16.

Claim.—"I claim the method used for promoting the drying or evaporating of the liquid matter from the packing, by drilling the holes 1, 1, 2, 2, and 3, 3, in the barrel, the said holes being afterwards filled with solder.

"I claim the method of making the joint at the end of the tube, which is effected by the friction of the packing around the tube, which forces the end of the tube against the bottom of the bore, and produces a joint, when the stuffing box is forced to its place, as herein mentioned and set forth."

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36. For an *Improvement in Shovel Ploughs;* James Lattimer, Chattoogaville, Georgia, March 16.

Claim.—"Having thus fully described my invention, what I claim therein as new is, the combination of the wing, or half shovel plough, and the adjustable scraper, arranged on different stocks in the said beam, when the said scraper is arranged on the land side and rearward of the plough, and so that the grass, weeds, &c., shoved off by the scraper, will be thrown into the furrow made by the plough, the whole being arranged in the manner and specially for the purpose herein set forth and fully shown."

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37. For an *Improvement in Cotton Gins;* Thomas J. Laws, Washington, Arkansas, March 16.

"The nature of my invention consists in the combination of an additional brush wheel, with the saws, and the stripping brush, of the ordinarily constructed cotton gin, in such a manner as to cause the said additional brush wheel to remove the motes from the cotton, while it is upon the teeth of the saws, by acting against the front sides of the said saw teeth, just before the cotton is stripped therefrom."

Claim.—"I do not claim the use of a mote brush. in combination with gin saws and the ordinary stripping brush, as I am aware that a cylindrical mote brush, revolving in the same direction with mine, has been used before; but what I do claim as new is, making the mote brush, (revolving in the direction described,) with wings, so as to act by a current of air, as well as by contact with the cotton on the teeth of the saws, substantially as herein set forth, in combination with the saws and grate."

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38. For an *Improvement in the Treatment of Hydro-Sulphurets, and in Manufacturing Carbonates and Sulphur Compounds;* Charles Lennig, Philadelphia, Pennsylvania, March 16.

Claim.—"What I claim as my invention is, the manufacture of carbonate of barytes and strontiæ, by processes as above described, and in combination therewith, employing the sulphuretted hydrogen gas, evolved in the aforesaid process, for the producing of sulphur, or sulphuric acid."

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39. For an *Improvement in Burners for Argand Lamps;* Austin Olcott, Rochester, New York, March 16.

Claim.—"What I claim as my invention in the within described lamp is, arranging the grooved tube for adjusting the wick inside of the wick and outside of the screw, that is, between the wick and the screw, and extending the pin from the wick holder, through the groove in the tube, into the score between the threads of the screw; thereby dispensing with the perforated tube heretofore used upon the outside of the wick, and leaving the wick open on the outside, so that the material to be burned may have free and unobstructed access around the wick."

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40. For an *Improvement in Machines for Cutting Screws on Rails and Posts of Bedsteads;* J. Parsons Owen, Norwalk, Ohio, March 16.

Claim.—I do not claim, of themselves only, reversible cutter heads, as such, or equivalent arrangements, have long been used, such as reversible cylinders and similar devices: but what I do claim as my invention is, constructing the reversible cutter heads E and F. of arms placed at right angles to one another, and carrying reverse right and left hand cutters *i i*, and *k k*, in combination with the eccentric snug *g*, and flanch *f*, of the screw spindle C, for the purposes and advantages specified, all being constructed and operating as shown and described."

41. For an *Improvement in Connecting Washers with Spindles in Spinning Machinery;* Horace T. Robbins, Lowell, Massachusetts, March 16.

Claim.—"I do not intend to confine my invention to the application of the spring, clasp, or holder, *a*, to the countersunk button, as the same holder may be used with a flat bottom, by having the bobbin countersunk, so as to let the bobbin down over the spring, clasp, or holder, such in fact constituting the peculiar essence of my invention. I therefore claim as my invention, the spring, clasp, or holder, *a*, or its equivalent, either with or without teeth, in combination with the spindle, or as applied and used therewith, substantially in the manner and for the purpose of holding the washer, as specified."

42. For an *Improvement in Planing Machines;* Daniel Stearns, Rome, New York, March 16.

Claim.—"What I claim as my invention is, constructing, arranging, and operating a reciprocating plane, which cuts off the shaving by its forward stroke, and feeds the board by its backward stroke, and the clamps and gripes, or stops, with which such a plane is connected, as herein described, so that the board is fed at the back stroke of the plane, and planed at its forward stroke, a distance equal, or thereabouts, to the throw or stroke of the plane, whereby a greater length is planed by a given number of strokes of the plane, than in reciprocating planes that feed themselves by their own motion, as heretofore constructed; and also, the injurious shocks and strains are avoided, which in those planes are caused by the necessity of making the cut considerably shorter than the stroke."

43. For an *Improvement in Cupping and Breast Glasses;* William S. Thomas, Norwich, New York, March 16.

"My invention consists in connecting the piston of an exhausting apparatus with the barrel thereof, by means of an elastic tube, which not only packs the piston, but also acts as a spring to draw the piston towards that end of the barrel to which the elastic tube is made fast."

Claim.—"What I claim as my invention is, the improved exhausting apparatus herein described, for surgical and other purposes; said apparatus consisting of a combination of a tubular spring piston with a barrel, substantially as herein set forth."

44. For an *Improvement in Pattern Cards for Jacquard Looms;* Samuel T. Thomas, Lowell, and Edward Everett, Lawrence, Massachusetts, March 16.

"The object of our invention is to facilitate the operation of changing the figure or pattern of cloth that is woven upon a jacquard loom, and to reduce the expense now incurred in changing and perforating the common pasteboard cards."

Claim.—"What we claim is, the combination of the buttons with the metallic card, as described, the buttons being so riveted or attached to the card as to allow of their being turned, for the purpose of closing or opening the holes to which they are respectively attached."

45. For an *Improvement in Hot Air Registers;* William Turton, Bushwick, New York, March 16.

Claim.—"What I claim is, the crown wheel or section of a crown wheel, in combination with the pinion wheel or section of wheel, attached to the fans as set forth."

46. For *Improvements in Railroad Car Brakes;* Thomas Walber, City of New York, March 16.

Claim.—"1st, I claim the arrangement of the followers, 3, 4, 5, and 6, with their brake blocks, 8, rods, *e* and *f*, and links, 9 and 10, whereby the power operating to separate the followers, 4 and 5, throws the brake blocks, 8, on to each side of each wheel, for the purposes and as described and shown.

"2d, I claim the steam piston and rod, *i*, wedge, *k*, and nut, *n*, and screw, *o*, in combination with the brakes, 3, 4, 5, and 6, arranged and acting as described, whereby the said brakes can be actuated by steam from the locomotive or by hand, as described."

47. For an *Improvement in Instruments for Inhaling Powders;* Ira Warren, Boston, Massachusetts, March 16.

"My instrument, or powder inhaler, is designed for the purpose of inhaling medicine into the throat and lungs, and at the same time to prevent any of the said medicine from lodging in the mouth."

Claim.—"Having thus described my powder inhaler, what I claim as my invention is, the instrument above described, for inhaling powder, &c., into the throat and lungs; the said instrument consisting of a receiver, with holes in its bulb or end, covered by and working loosely in an exterior tube, which prevents any of the medicine from lodging in the mouth, substantially as above described."

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48. For an *Improvement in Hinges for Stove Doors, &c.;* Charles J. Woolson, Cleveland, Ohio, March 16.

Claim.—"What I claim as my invention is, the connecting and hanging of the door or doors upon the fronts of stoves or grates, so that they may be opened or closed, without marring the beauty or affecting the convenience of the same, in either case, or exposing to view the hinges or inside of the door, as described."

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49. For an *Improved Arrangement of Jack Chain Machinery;* Hickford Marshall and Seth S. Cook, Assignors to John Bostwick, Jr., and Elbert White, Stamford, Connecticut, March 16.

Claim.—"What we claim as our invention is, the arrangement on the bed plate, A, of the nipping jaw, G, the mandrel, E, and pin, F, with the turning lever, K, furnished with pin, *f*, moving under the table, B, in the manner and for the purpose substantially as set forth and shown."

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50. For an *Improvement in Omnibus Steps;* Josiah Ashenfelder, Philadelphia, Pennsylvania, March 23.

"The nature of my invention consists in an inclined covering or protector, immediately connected with the outside of the door, so secured thereto as to open and shut therewith, with a brush or broom secured to the bottom of the covering as to open and shut therewith, for the purpose of cleansing the step or steps, together with a back board, operating as a protection to the inside of the step, so as to prevent mud, &c., from being thrown upon the same."

Claim.—"What I claim as my invention is, the application of the inclined covering or protector to the outside of the omnibus door, as described, to prevent persons from standing, lying, or sitting on the steps, in combination with the brush or broom, secured to the bottom of the covering or protector, so as to open and shut therewith, for the purpose of cleansing the step or steps, each step, if more than one, requiring a brush or broom attached, together with a back board to protect the inside of the step, as described."

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51. For an *Improvement in Shop Awnings;* William H. Bakewell, City of New York, March 23.

Claim.—"Having thus fully described my invention and improvement, I wish it to be known that I do not claim the pullies, cords, cog wheels, &c.; neither do I claim the enclosing of an awning, as that has already been done in many different ways, to my knowledge. What I do claim as my invention is, the method of protecting the awning, by the construction and arrangement of the cylindrical sheathing or covering, in combination with the slat, in the manner and for the purpose herein described and fully set forth."

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52. For *Improvements in Machines for Stamping Ores;* William Ball, Chicopee, Massachusetts, March 23.

Claim.—"What I claim as my invention is, the combination of the washing basin or contrivance, L, with the stamp rod and its bearing, so as to operate in manner and for the purpose as specified.

"I also claim the deflective plate in the entrance spout or hopper, as combined with the same, and the mortar and stamper, and used for the purpose as specified.

"I also claim the improvement in the stamp head, or the making of it with a greater stamping surface on one side of its axis of rotation than it is on the other; the same being for the purpose of preventing packing of the charge, as specified.

"I also claim the mode of applying the stamp head to the stamp rod, viz: by means of the circular arcs or curves of the sides of the universal dovetail connexion with the wedge key, as described."

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53. For an *Improvement in Ploughs;* E. Ball, Greentown, Assignor to Isaac N. McAbee, Canton, Ohio, March 23.

Claim.—"What I claim as my invention is, connecting the beam to the plough irons by means of a pivot and stay bolt, and adjustable standard; the whole being constructed and arranged as described, so that the front end of the beam can be set towards either side, or either extremity raised or lowered, without changing the height of the other, or both extremities raised simultaneously and equally, or unequally, substantially as set forth."

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54. For an *Improvement in Friction Primers for Cannon;* William Ball, Chicopee, Massachusetts, March 23.

Claim.—"I claim the combining with the discharging string and tube of the primer, a cylinder or plug of leather, or other like substance, inserted and secured in the upper end of the primer, and having the exploding string passing through it, as above set forth; the said plug or cylinder serving the purpose of a breech, to confine the charge when exploded, as a protector of the sand paper and priming, against the absorption of humidity, and as a bearing for the string to draw over when pulled."

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55. For an *Improvement in Machinery for Felting Cloth;* George G. Bishop, Norwalk, Connecticut, March 23; ante-dated September 23, 1851.

Claim.—"What I claim as my invention is, the method herein described of hardening the bat by alternate steaming and jigging, substantially as herein set forth, whereby one section of the bat is jiggered, while an adjoining section is steamed, preparatory to being jiggered.

"I also claim the process of steaming and jiggering two or more bats simultaneously, whereby much time and labor are saved, and the texture of the cloth is improved.

"I also claim constructing a machine for jiggering felt bats, in such manner that it will subject successive portions of the bats to equal amounts of jiggering, and then stop, whereby a greater uniformity of texture is secured in the cloth.

"I also claim the arrangement of the steam pipes and adjutages in the steam chamber, substantially in the manner and for the purpose herein set forth."

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56. For an *Improvement in Marine Signals;* Thomas H. Dodge, Nashua, New Hampshire, March 23.

Claim.—"What I claim as my invention is, the employment for signaling or indicating the course of a vessel, of two lights of different colors, attached to or hung in a cylinder or disk, which is capable of revolving on a fixed axis, so as to change the position of the lights; the position of either light, relatively to the other, being made to point the course in any manner, substantially as described."

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57. For *Improvements in Planing Machines;* John Howarth, Salem, Massachusetts, March 23.

Claim.—"What I claim as my invention is, the reciprocating plane for scoring the face of the board transversely, and reducing it to an uniform thickness, arranged substantially as herein described, in a compound frame, which carries the plane back and forth across the board by a regular and positive motion, and back and forth lengthwise of the board by a motion dependent upon the reciprocal action of the board against the planes in one direction, and of springs against the frame in the opposite direction, substantially as herein set forth.

"I also claim the method of smoothing the surface of boards or other lumber, by plane irons reciprocating endwise, and operated in such manner that the tendency of one to

draw the board towards that side of the machine to which it is moving, is counteracted in whole or in part by the tendency of one or more of the others to draw the board towards the opposite side of the machine; these several counter tendencies being thus made to neutralize each other, substantially as described."

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58. For an *Improvement in Swingle-Trees;* Charles Howard, Madison County, Illinois, March 23.

Claim.—"I do not claim the ring and link as my invention; but what I do claim is, the flanch, as above set forth, wrought or cast, in combination with the ring and link, for the purpose of forming attachments, substantially in the mode set forth above."

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59. For *Improvements in Machines for Making Cordage;* William Joslin, Waterford, New York, March 23.

Claim.—"What I claim as my invention is, the application of the fan *j k*, in combination with the pullies *f h*, belt *g*, gears N, O, P, Q, and bobbin M, as a drag, or take-up, as above described."

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60. For an *Improvement in Flour Packers;* Nathan Kinman, Lewistown, New York, March 23.

"The nature of my invention consists of a spiral cone plate, for the packing of flour, so as to give to the flour an equal density throughout the barrel, and also a friction roller clutch to work in connexion with the above mentioned spiral cone plate."

Claim.—"What I claim as my invention in the above described machine for packing flour, is the friction roller clutch, constructed and arranged in the manner and for the purpose substantially as set forth."

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61. For *Improvements in Smut Machines;* Thomas H. M'Cray, Madisonville, Tennessee, March 23.

Claim.—"What I claim as my invention is, the formation of a series of corrugated recesses within the periphery of the cylindrical casing of my improved smut machine, substantially of the forms represented in the drawings, when the said cylindrical casing is combined with a rotating beater, which has its beating surfaces *a a*, &c., arranged in positions which incline obliquely to the radii of the beater, for the purpose of throwing the smut and kernels of grain into the said series of corrugated recesses, in such directions that they will, in entering and rebounding therefrom, be brought in contact with their entire surfaces, and thereby produce so great an amount of friction action as to break up the smut and white caps, and polish the kernels of grain, without breaking the same."

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62. For an *Improvement in Cracker Machines;* John M'Collum, City of New York, March 23.

"The nature of my invention consists in attaching to the frame of the cracker machine, a set of springs, in such a manner as to let the bed plate rest upon them, and as the cutters are forced down to cut the dough, to yield or recede under the pressure, and thereby prevent the sudden cut of the knives on the apron, and at the same time keep them longer in contact with the apron, to take their "scraps," than would be the case if the bed plate was made permanently fast to the frame, and the knives suddenly impinged upon it, and then receded."

Claim.—"Having now described my invention and its operation, what I claim, therefore, is the use of the bed plate resting upon or supported by springs, or other equivalent devices, so that a yielding or receding action is obtained in the bed plate, while under the pressure of the cutters, or while the cutters are pressing down, for the purposes and in principle of construction and operation, substantially as set forth."

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63. For an *Improvement in Manufacturing Artificial Teeth;* William S. McIlhenny, Philadelphia, Pennsylvania, March 23.

"The nature of my invention consists in the manufacture of a tooth, or teeth, into a condition ready for the furnace, by the simple process of moulding."

Claim.—"What I claim as my invention is, the formation of an artificial tooth or teeth, from spar, silex, clay, sand, glass, or any materials used for the above purpose, into a suitable condition for the finishing furnace, by the simple operation of moulding, thereby avoiding the tedious and uncertain process of enameling."

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64. For an *Improvement in Machines for Paging Books;* Stephen E. Parrish, Assignor to Edwin B. Clayton & Sons, City of New York, March 23.

"The nature of my invention consists in combining together, a series of number or letter plates, upon a cylinder or barrel, and cutting on the peripheries of the plates, a series of numbers or letters, from one to the decimal point, and by means of springs and pins, attached thereto, and holes through the plates corresponding with the number of letters on their peripheries, and a changer plate, attached to the end of the cylinder, operated by a cap plate, having a ratchet and pawl contained therein, made to count or number from 1 to 99,999, as the circumstances require."

Claim.—"Having now described my invention and its operation, what I claim, therefore, is, 1st, the use of the type plates, having channel ways and springs in their faces, and holes in them, corresponding to the ten subdivisions of their peripheries, and their inner circumferences divided into ten equal sides, in combination with a barrel having stop pins in its circumference. for the type plates and a changing plate attached thereto, and ratchet wheel, cap plate, and pawl and bent lever, for the purpose of operating a series of number plates, the said combination of parts being entirely distinct from any known mode of producing the same result, (that is, counting.) which I lay no exclusive claim to, the principle being well known; and I therefore limit my claim to combination of parts, substantially as set forth.

"2d, I claim the use of the rod C, lever E, inking roller lever J, and arm I, in combination with the type wheel, substantially for the purposes as set forth.

"3d, I claim the use of the inking roller frame and rod attached thereto, and rotating ink plate, in combination with the lever J, slide O, and type wheel and levers operating the same, substantially for the purposes as set forth.

"4th, I claim the bed R, with guides attached thereto, in combination with the table and type wheel, substantially for the purposes as set forth."

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65. For an *Improvement in Machines for Jointing Shingles;* William Stoddard, Lowell, Massachusetts, March 23.

"My improvements consist, 1st, in the arrangement by which I am enabled to point the shingle, and plane or shave both sides at the same time, this effect being produced by planing knives, set in plane stocks, moving vertically, the operation of which will be hereinafter explained. I have also made an improvement by which the machine will cut or joint the edges of any width of shingle, the shingle itself serving to regulate the position of the jointing knives."

Claim.—"Having thus described my improvements in shingle machines, what I claim as my invention is, the arrangement of the horizontal sliding boxes, which carry the jointing knives, by which they will cut the edges of any width of shingle, the shingle itself operating the devices for holding the boxes firmly, and in the proper position, while the shingle is being cut as herein above set forth."

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66. For an *Improvement in Air-Heating Stoves;* J. M. Thatcher, Lansingburgh, New York, March 23.

Claim.—"What I claim as my invention is, the combination of the inverted domes, or frustums F, I, M, and plate P, with the short tubes *b b*, *f f*, *i i*, *l l*, connecting them substantially in the manner herein described, for the purpose of effecting the connexion between the lower ends of the fire or draft flues, and carrying the air through them to the spaces between the cylinders or tubes."

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67. For an *Improvement in Making Paraffine Oil;* James Young, Manchester, England, March 23; patented in England, October 7, 1850.

Claim.—"What I claim as my invention is, the obtaining of paraffine oil, or an oil containing paraffine, and paraffine from bituminous coals, by treating them in manner herein before described."

68. For an *Improvement in Sausage Stuffers;* Thomas W. Bailey, Lewistown, Pennsylvania, March 30.

Claim.—"Having thus fully described my improved sausage stuffer, what I claim therein is, the combination of the three cornered ovoid shaped cylinder, with the curved spring scraper, operating in the manner and for the purpose, substantially as herein fully set forth."

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69. For an *Improvement in Mills for Grinding Ores;* William Ball, Chicopee, Massachusetts, March 30.

Claim.—"What I claim as my invention is, the combination and arrangement of the two grinding, or pulverizing wheels, one or two endless screws, and the troughs which such wheels and screw, or screws, revolve in, all made and applied so as to operate together, in such manner as to raise the ore up and crush it between the two wheels, and not only return, or move the heavier or too weighty particles towards or back to the wheels, but allow the lighter ones or sufficiently reduced particles to flow out of the machine, as described."

---

70. For an *Improvement in Excavating Machines;* Charles Bishop, Norwalk, Ohio, March 30.

"This invention consists in the employment of an inclined cutter wheel, so constructed that it serves also as a horse walk, by which means the power is applied directly to the wheel itself, without the intervention of other mechanism."

Claim.—"I do not claim inclining the cutter cylinder; neither do I claim placing the horses within or upon ditching machines, for the purpose of working them: but what I claim is, so constructing the inclined wheel or cutting cylinder E, that it is made also to serve the purpose of horse walk, by which means the power of the horse is applied directly to the cylinder itself, without the intervention of other mechanism, substantially as herein described."

---

71. For an *Improvement in Trusses;* Frederick M. Butler, City of New York, March 30.

Claim.—"What I claim as my invention is, the application of trusses and supporters of the guard spring pad, as above described."

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72. For *Improvements in Machinery for Shaving the Heads of Screw Blanks, Rivets, etc.;* John Crum, Ramapo, New York, March 30.

Claim.—"What I claim as my invention is, the movable stop, which determines the position of the screw blanks between the jaws, and then returns to let said blanks fall through, substantially as specified, in combination with the vertical hollow spindle or mandrel, as specified.

"And finally, I claim the feeding tube, which conducts the screw blank, &c., to the hollow spindle, substantially as specified, in combination with the cam on the cutter head, or its equivalent, for moving the said tube out of the way of the cutter, as described."

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73 For an *Improvement in Razor Strops;* John Demerit, Montpelier, Vermont, March 30.

"The nature of my invention consists in attaching the strop, at the ends, to the case containing it, in such a way that it will be suspended, and revolve, without the edges touching the case."

Claim.—"What I claim as my invention is, the mode of attaching the strop to the case, so that it will not be soiled by the faces of it coming in contact with the case, and so that it will revolve, as herein described, using for that purpose, the aforesaid case, strop, bearing spring, and pivots, in combination."

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74. For an *Improvement in Dredging Machines;* James Hamilton, City of New York, March 30; patented in France, December 16, 1845.

Claim.—"I do not limit myself to the means described for raising and lowering the frame, nor to the shapes of the shovels or scoops, or the means of moving them, as other

mechanical means, shapes, or arrangements, may be used; neither do I limit myself in the number of the shovels, or scoops, or the proportions of the parts.

"1st, I claim the shovels or scoops, forming the bottoms of compartments in a proper frame, and moving at one end on a hinge, or similar contrivance, the other end being lowered, to cause the scoop, as the frame is moved along, to collect the sand, or mud, or other material operated on, and retain the same by suitable mechanical means, operating to lift the scoop and close the bottom, as described and shown."

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75. For an *Improvement in Rice Hullers;* Peter McKinlay, Charleston, South Carolina, March 30.

"The nature of my invention consists in having a circular conical chamber, into which the rice is put after having the outside shell taken off by a pair of stones, operated on in the usual way; the rice, after having the outer shell taken off, has still a thin film or skin on it, of a dark color.

"The object of my invention is, to take off this skin or film, by rotary friction, without breaking the grain, by which means the market value of the article is increased."

Claim.—"I claim as my invention, the combination of the concave fluted chambers, with the smooth curved radial beaters for hulling rice, as set forth."

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76. For an *Improvement in Shovel Ploughs;* Washington F. Pagett, Stone Bridge, Virginia, March 30.

Claim.—"What I claim as my invention is, the construction of the handles, and the principle or mode of shifting the same, as the same are herein fully described, with their operation; the invention of the common shovel plough is, of course, disclaimed."

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77. For *Electric Whaling Apparatus;* Dr. Albert Sonnenburg and Philipp Rechten, Bremen, Germany, Assignors to Christian A. Hainaken, United States, March 30.

"The nature of our invention consists in catching and securing sperm and right whales, as well as other animals of the sea, by the application of electric galvanic current, conveyed by a conductor to the instrument commonly called whale iron, or harpoon, and which is used to be thrown into the fish."

Claim.—"What we claim as our invention is, the application of electric galvanic current, conveyed by a conductor to an instrument which is to be thrown into sperm and right whales, as well as other animals of the sea, in order to secure them."

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78. For an *Improvement in Gang Ploughs;* Harvey Killam and George Valleau, Scottsville, New York, March 30.

Claim.—"Having thus described our improvements in the wheeled cultivating gang plough, we will state that we are aware that axles of wheels have been hung to the frame of the carriage, so as to vibrate, or be suffered to vibrate, and keep them at right angles to the motion of the ploughs, when moving in a direct line, and when the ploughs are turning the axles, being made to assume a line in the direction of the radius of the circle formed by the track of each wheel. We are also aware that gangs of ploughs have been placed diagonally, one behind the other, and the wheels of the carriage of the same also placed diagonally, one behind the other; therefore, we lay no claim to these parts. But what we do claim as our invention is, mounting the tongue or pole upon the timbers, and uniting the same by an intermediate jointed connecting rod, to the horizontal coupling rod, which unites the front and rearward ends of the pivoted arms of the axles, whereby the direction or guiding of the gang of ploughs is regulated by the action of the team itself, in moving in any direction the attendant may require.

"We also claim confining the tongue or pole between the horizontal plate and timber, by means of a fulcrum bolt, for the purpose of allowing the tongue or pole to vibrate, or move right or left, with the direction of the team; whereby the required direction is given to the propelling and supporting wheels, and whereby the tongue or pole may be shifted or adjusted in its position, to accommodate two or three horses, and yet maintain its central draft with the ploughs."

79. For an *Improvement in Bedstead Fastenings;* William Shaw, Clarion, Pennsylvania, March 30.

Claim.—"What I claim as my invention is, the combined actions, or the combination of the link and wedge as above described, for fastening bedsteads."

80. For an *Improvement in Rat Traps;* James Sheward, Somerset, Ohio, March 30.

Claim.—"I do not claim any arrangement by which a living animal may be forced into a cage and retained; nor any arrangement by which an animal may be killed and its body retained: but what I claim as my invention is, the manner of constructing a machine for the killing of animals and throwing their bodies from the trap, and self-setting the same, substantially as described and shown."

81. For an *Improvement in Apparatus for Boring Artesian Wells;* John Thomson, Philadelphia, Pennsylvania, March 30.

Claim.—"What I claim as new is, the spring or brace, as above described, or its equivalent, with the twisted flat bar, or other device, turning systematically the boring instrument, whilst using a rope instead of rods, while sinking a bore-hole in the earth, in search of water or minerals."

82. For an *Improvement in Smoothing Irons;* Nicholas Taliaferro, Augusta, Ky., and William D. Cummings, Murphysville, Kentucky, March 30.

"The object of our invention is, to render practicable the permanent heating of smoothing irons, chiefly by the proper regulation and distribution of the draft to a charcoal or other fire within the iron, by an arrangement which prevents also the spilling of the ashes and refuse of combustion."

Claim.—"Having thus fully, clearly, and exactly described the nature, construction, and operation of our improved smoothing iron, what we claim therein as new is, the application, substantially as described, to a self-heating smoothing iron, of a tube or chamber, at the bottom of the fire-box, provided with a registered mouth or inlet, some distance above the bottom, and at its lower portion with distributing apertures, communicating with the fire, whereby the draft is applied from beneath, and equally at every part, and placed under the control of the operator, without permitting the escape of ashes, or other refuse of combustion."

83. For an *Improvement in Candle Wicks;* Cornelius A. Wortendyke, Godwinville, New Jersey, March 30.

Claim.—"I claim a candle wick, manufactured by the method herein specifically described."

Re-issues for March, 1852.

1. For an *Improvement in Machines for Planing, Tonguing, and Grooving;* Joseph Powell, Nelson Barlow, and Edward Holden, St. Louis, Missouri, Assignors to Robert G. Eunson, City of New York; patented February 27, 1847; re-issued March 9, 1852.

"The nature of this invention relates, 1st, To a method of springing and holding or confining the board or plank to the bed plate, while the thicknessing or reducing wheel or planes are operated upon it; 2d, To certain improved means of forming the tongue; and. 3d, To certain means of forming the groove."

Claim.—"What I claim as the invention of the aforesaid Joseph Powell, Nelson Barlow, and Edward Holden, and what I desire to secure by the re-issue of the letters patent granted originally to them, is, 1st, The combination of the pairs of feeding rollers, G G, and G′ G′, with the bed plate, C, and the rotating reducing wheel, D, substantially in the manner and for the purpose herein set forth, viz: the placing the axles of the pair of feeding rollers, G G, preceding the reducing cutter wheel, and the axles of the pair of feeding rollers, G′ G′, immediately following the same, respectively, out of a vertical line with

each other, thereby bringing the upper roller of each pair nearer to the shaft of the reducing wheel than the lower one, for the purpose of springing the board or plank to the bed plate, as herein more particularly described.

"2d, In making the rebates by which the tongue is formed, I claim the employment of a series of incising cutters, in combination with stationary planing tonguing cutters, the several cutters being so arranged as to act upon both sides of the angle of the rebate, simultaneously or alternately, and cut the shavings from both the said sides, so as to form at one operation a tongue, both of whose sides and shoulders have been subjected to the action of cutting edges, substantially as herein set forth.

"3d, In forming the groove, I claim the employment of a series of incising cutters, in combination with stationary planing grooving cutters, substantially as described, for forming the tongue, being arranged so as to cut upon both sides and the bottom of the groove, as set forth."

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2. For an *Improvement in Machinery for Dressing Staves;* Isaac Judson, New Haven Connecticut; patented May 1, 1847; re-issued March 9, 1852.

Claim.—"What I claim as my invention is, 1st, The arrangement of the wheel and ring of cutters, for the purpose and in the manner substantially as herein before described.

"2d, The holding of the stave firmly in position to be dressed, in the immediate vicinity of that portion which is being cut, while all the other portions are left at full liberty to assume whatever position its configuration may indicate for the purposes and in the manner substantially as herein before described.

"3d, The employment of the two independent spring rollers, or their equivalent, acting with equal force upon each of the edges of the stave, irrespective of their relative thickness, in combination with the guides and the cutters, as described."

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3. For a *Powder Proof Lock;* William Hall, Boston, Massachusetts; patented August 1, 1848; re-issued March 30, 1852.

Claim.—"What I claim as my invention is, the combination of the handle shank and cam, one or more pins, and their sustaining holes or apertures, in their application to the belt, and one or more tumblers, and as operated substantially as specified, meaning to claim said combination as composed of the afore described elements and their accessories, to combine with or in combination with the bolt and tumblers; a contrivance for throwing or moving the bolt back and forth; another, or a key, separate and distinct from such contrivance, and for the purpose of moving the tumblers into correct positions for the bolt to be moved, and which shall be perfectly stationary, after it has so moved the tumblers; and a movable plate, or its equivalent, applied to the contrivance, by which the bolt is actuated, and made to entirely cover the key, and prevent access to it, when the bolt is put in motion; not meaning by the above to claim the separate combination of either of the above mentioned three parts, with the bolt and tumblers, but intending to limit my claim to the combination of all of them therewith, so as to operate in conjunction with them, essentially as specified."

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48. For an *Improvement in the Gearing of a Seed Planter;* Marshall J. Hunt, Rising Sun, Maryland; patented June 3, 1851; re-issued March 30, 1852.

Claim.—"Having thus fully described my invention, what I claim therein as new is, in combination with the slotted sliding seed bar, the stationary lugs on the plate, and the concave on the cap; the whole being arranged and constructed as herein described.

"I also claim the combination and arrangement of the double bolt, with its slotted arm, rock shaft, with its arms, and pitman, for the double purpose of giving motion to the feeding apparatus, and also regulating the quantity of seed to be sown, when said pitman is operated by a long crank, upon which it travels, as herein fully shown and represented."

Design for March, 1852.

1. For a *Design for a Cooking Stove;* Samuel M. Carpenter, Erie, Pennsylvania March 30.

Claim.—"Upon the general arrangement of said ornaments upon said stove, as an original design, your petitioner asks a patent under the provisions of law in such case made and provided."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Remarks on H. B. M. Screw Steam Frigate "Arrogant." By Chief Engineer, B. F. Isherwood, *U. S. Navy.*

The *Arrogant* has long been considered the most successful application of an auxiliary screw to a war steamship. Having been furnished directly from her Chief Engineer with a number of her indicator cards, and accompanying data of speed, revolutions of screw, &c., I thought it might be of interest to steam engineers and ship constructors, to publish these results, giving additionally the full dimensions of *hull*, *engine*, *boilers*, and *screw*, obtained from the Chief Engineer of the vessel and other sources, in order that a correct opinion might be formed. As these results may be relied on, they will go far to correct some very exaggerated reports of the performance of this vessel, as well as to show the latest manner of using steam in the British Navy.

Hull.

Length between perpendiculars,	200 feet.
Length of keel for tonnage,	172 " $9\frac{5}{8}$ inches.
Breadth, extreme,	45 " $8\frac{1}{2}$ "
Breadth, moulded,	44 " 4 "
Depth of lower hold,	15 " 1 "
Mean draft, half coal in, and all other weights full,	19 " 0 "
Burthen,	1872 tons.
Displacement at 19 feet draft,	2470 "
Immersed amidship section at 19 feet draft,	587 square feet.

Engines.—Two of Penn's horizontal trunk, condensing engines, placed on board at Woolwich in 1848. The exhaust pipe, which is the highest part of the engines, is 4 feet 8 inches below the water line; the tops of the cylinders are 6 feet 11 in. below water line.

Diameter of cylinder, 60 inches, } " trunks, 24 " } equivalent to a diameter of	55 inches.
Stroke of piston,	3 feet.
Space displacement of both pistons per stroke,	98·99 cubic feet.
Diameter of main steam pipe,	18 inches.
Leading into steam pipe of diameter of	14 "
Diameter of eduction pipes,	18 "
Diameter of overflow pipes,	18 "
Extreme length of engine and boiler rooms, bulkhead to bulkhead,	56 feet.

Slide Valves.

Lead on top lid, or lid to cylinder cover,	3-16 inch.
Lead on bottom lid,	5-16 "
Carries steam on top stroke,	28 inches.
" bottom stroke,	26 "
Lead of exhaust on top lid of valve,	$7\frac{1}{2}$ "
" bottom lid of valve,	$7\frac{1}{2}$ "
Length of slide faces,	9 "
Length of ports,	5 7-16 "
Exhaust ports at bottom,	$3\frac{5}{8}$ "
" top,	$3\frac{1}{8}$ "

Note.—When steam is admitted into the top end of the cylinder, the exhaust port is open 3 15-16 inches; and when admitted into the bottom end, the exhaust port is open $3\frac{3}{4}$ inches. The lead at the crank end of the cylinder is 5-16 inch, and at the cylinder cover end 3-16 inch.

Shafting.

Diameter of shaft at main bearing,	$10\frac{1}{2}$ inches.
" connecting shaft bearing,	$9\frac{1}{2}$ "
" screw propeller shaft at large end,	14 "
" " " small end,	9 "

Length of shafting from inside of stern post to forward part of coupling on crank shaft, ...	69 feet 1 inch.

Boilers.—Four horizontal tubular boilers, placed in such a manner that the top of the steam chest is 3 feet 4 inches below the water line.

Number of tubes in each boiler, ...		264.
Outside diameter of tubes, ...		$2\frac{1}{2}$ inches.
Length of tubes, ...		5 feet 6 inches.
Length of each boiler, ...		12 " 3 "
Breadth "		10 " 7 "
Height "		7 " 4 "
Number of furnaces in each boiler, ...		3.
Length of each furnace, that is, of grate bars in each furnace,		5 feet.
Breadth " " "		3 "
Area of total grate surface, ...		180 square feet.
" heating " in tubes,	3800·544 sq. ft.	
" " " furnaces, &c.,	634·000 "	
Area of total heating surface in the 4 boilers,		4434.544 sq. feet.
Extreme height of chimney when up above grates, .		44 feet.
Length of upper or sliding part of chimney, . .		15 feet 8 inches.
Diameter of lower or fixed part of chimney, . .		5 " $3\frac{3}{4}$ "
" upper or sliding part "		5 " $1\frac{1}{4}$ "
Weight of water in boilers, ...		39 tons.
Consumption of English bituminous coal per 24 hours, working with full power at sea with steam alone, in good weather, boiler pressure 5 pounds per square inch, cut off at $\frac{3}{4}$ths the stroke from commencement, making $44\frac{2}{3}$ double strokes of piston per minute, initial cylinder pressure 18 pounds per square inch, ...		32 tons.
Sea water evaporated under the above circumstances by one pound of coal, inclusive of loss by blowing off at 3-32, and by waste of steam in clearance and nozzles, . .		6·836 pounds.
Coal consumed per hour per square foot of grate surface, .		16·600 "

Weight of coal carried in bunkers, 260 tons, or sufficient for 8 days steaming at full power.

Screw.—One true screw, placed at the stern in a sliding frame, so as to be raised out of water when the ship is under sail alone.

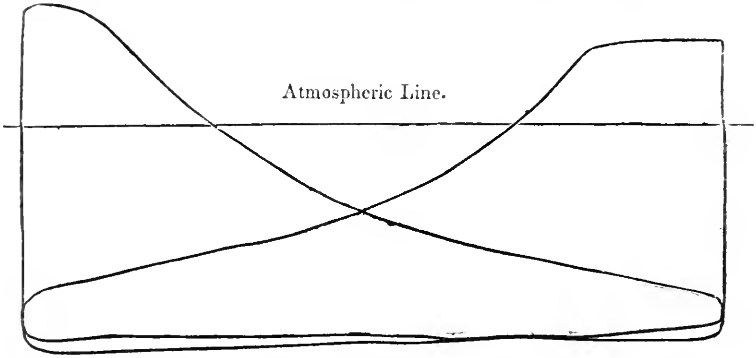
Diameter, ...	15 feet 6 inches.
Pitch, ...	15 " 0 "
Length on axis, ...	2 " 6 "
Number of blades, ...	2.
Helicoidal area of screw, ...	136 square feet.
Area of screw projected on a plane at right angles to axis,	61·85 "

Results.

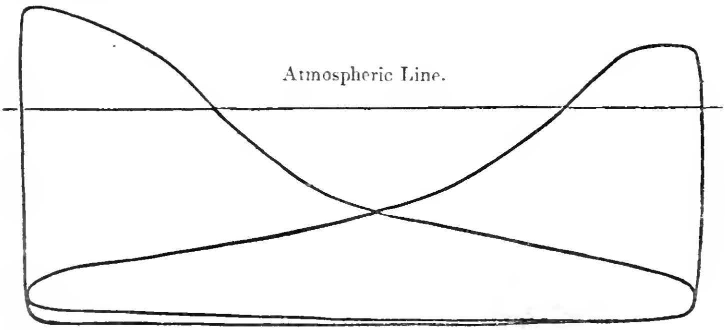
Speed of vessel at sea under steam alone, in good weather, working at the reduced power used in calms and smooth water, viz: cutting off at about $\frac{1}{3}$th from commencement of stroke, and having a mean effective pressure per square inch of pistons throughout the stroke of $7\frac{3}{5}$ pounds, making $33\frac{2}{3}$ double strokes of piston per minute, .	3·833 knots of $6082\frac{2}{3}$ feet.
Horses power developed by engines under the above circumstances, ...	223·99
Speed of vessel at sea under steam alone, in good weather, working with full power, viz: an initial pressure in cylinder of 18 pounds per square inch, cutting off at $\frac{3}{4}$ths the stroke from the commencement, giving a mean effective pressure throughout the stroke of $13\frac{1}{2}$ lbs. per square inch of pistons, making $44\frac{2}{3}$ double strokes of piston per minute,	5·08 knots of $6082\frac{2}{3}$ feet.
Horses power developed by engines under the above circumstances, ...	520·96
Slip of the screw under the above circumstances, .	23·04 per cent.

INDICATOR DIAGRAMS FROM STEAM CYLINDERS. SCALE, 10 POUNDS TO THE INCH.

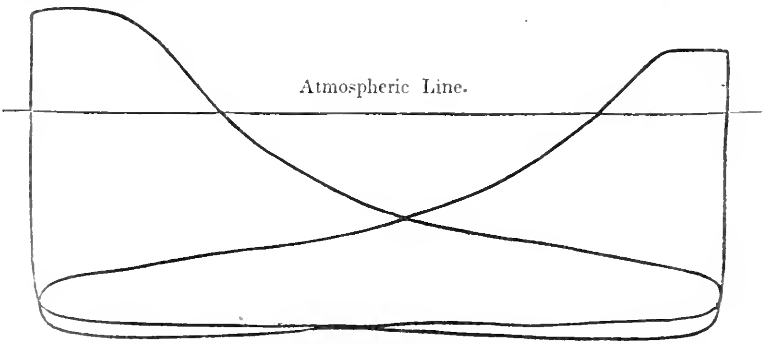
No. 1.—Taken August 4th, 1851. Sea smooth, and variable head airs; speed by paten log, 3·70 knots per hour; revolutions of the screw, 33 per minute; mean effective pressure per square inch of piston, 8·14 pounds. *Slip of the screw,* 24·22 *per cent.*



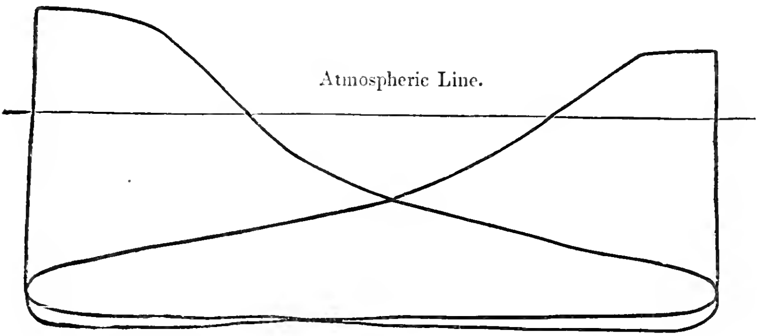
No. 2.—Taken August 5th, 1851. Moderate head swell, and airs ahead; speed by patent log, 4 knots per hour; revolutions of the screw, 34 per minute; mean effective pressure per square inch of piston, 7·48 pounds. *Slip of the screw,* 20·49 *per cent.*



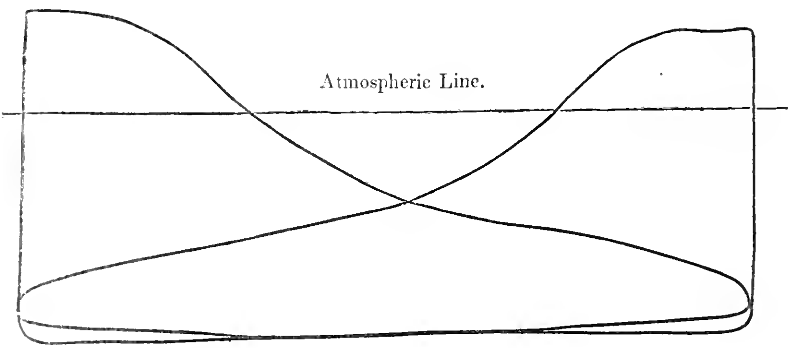
No. 3.—Taken August 4th, 1851. Sea smooth; fore and aft sails set; speed by patent log, 5·8 knots per hour; revolutions of the screw, 34 per minute; mean effective pressure per square inch of piston, 7·69 pounds. *Negative slip of the screw,* 15·29 *per cent.*



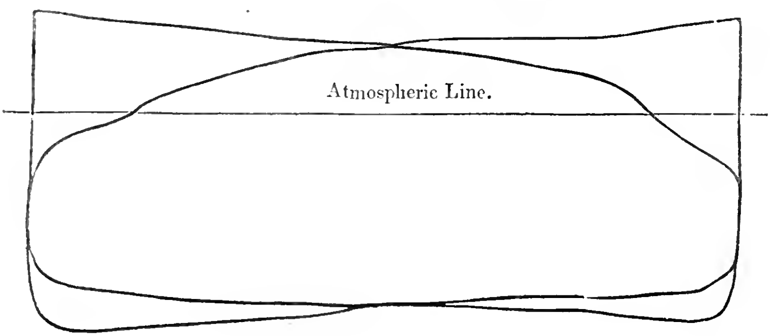
No. 4.—Taken August 5th, 1851. Sea smooth; calms and head airs; speed by patent log, 3·80 knots per hour; revolutions of the screw, 34 per minute; mean effective pressure per square inch of piston, 7·35 pounds. *Slip of the screw,* 24·46 *per cent.*



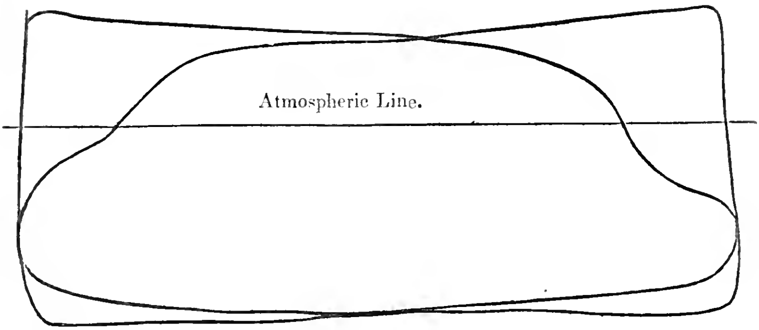
No. 5.—Taken May 4th, 1850. Sea and wind not noted; speed by patent log, 4·20 knots per hour; revolutions of the screw, 40 per minute; mean effective pressure per square inch of piston, 8·08 pounds. *Slip of the screw,* 29·04 *per cent.*



No. 6.—Taken August 5th, 1851. Sea and wind not noted; speed by patent log, 4·20 knots per hour; revolutions of the screw, 51 per minute; mean effective pressure per square inch of piston, 12·99 pounds. *Slip of the screw,* 44·34 *per cent.*



No. 7.—Taken August 2d, 1851, leaving Gibraltar for Lisbon. Sea smooth, strong free wind, and all sail set; speed by patent log, 10·60 knots per hour; revolutions of the screw, 64 per minute; mean effective pressure per square inch of piston, 13·88 pounds. *Negative slip of the screw*, 11·94 *per cent.*



All the above diagrams, excepting No. 5, were taken on a passage from Gibraltar to Lisbon, with a mean draft of about 19 feet, and show the performance of the vessel under the most favorable circumstances, having a smooth sea and short run.

Under these favorable circumstances, the mean performance at sea, under steam alone, was for full power; that is, a mean effective pressure of $13\frac{1}{2}$ pounds per square inch of piston, and $44\frac{2}{3}$ double strokes of piston per minute, 5·08 knots; and for the reduced power used in calms and fine weather, viz: a mean effective pressure of $7\frac{2}{3}$ pounds per square inch of piston, obtained by cutting off at about $\frac{1}{8}$th the stroke from the commencement, and $33\frac{2}{3}$ double strokes of piston per minute, a speed of 3·833 knots per hour. These are slow speeds, and would not by any means be considered satisfactory in our Navy. Every war steamship with us, having a less average sea speed than 9 knots per hour, is pronounced a failure, without regard to the comparative power of the machinery, consumption of fuel, and size of vessel. It is thus that nearly all our Navy steamships are failures; but fairly compared relatively, power with power, fuel with fuel, and size of vessel with size of vessel, I believe our Navy war steamships will be found to give higher results, both in the generation of steam, its mode of use in the engine, and application to the propelling instrument, than can be found elsewhere, at home or abroad.

These diagrams also show in a very striking manner, the effect of using sail in conjunction with the screw, and the existence of what is termed *negative* slip. A few remarks on this subject may be of use in this connexion; sufficient data being luckily furnished by a trial of the *Arrogant* in the Thames river.

January 8th, 1849, the *Arrogant*, drawing 16 feet 10 inches forward, and 18 feet 9 inches aft, was tried at the measured mile in the Thames river, and made at the rate of 7·25 knots per hour; revolutions of the screw, 63 per minute; mean effective pressure per square inch of pistons by indicator, 13·31 pounds; horses power developed by the engines, 672·7. *Slip of the screw*, 22·23 *per cent.*

August 2d, 1851, the *Arrogant*, leaving Gibraltar for Lisbon, made, in smooth water, strong free wind, and all sail set, 10·60 knots per hour by patent log; revolutions of the screw, 64 per minute; mean effective pressure per square inch of pistons by indicator, 13·88 pounds; horses power developed by the engines, 767·45. The screw had now what may be termed a *negative* slip of 11·94 per cent.; that is, the speed of the vessel was 11·94 per cent. *greater* than the speed of the screw.

It may now be supposed that the screw, instead of assisting the progress of the vessel, was retarding it by dragging. That this was not the case, however, and that the screw under the above conditions was still actually propelling the vessel, will become evident from a consideration of the performance of the vessel in the Thames river, as given in the paragraph above.

During that performance, with 63 revolutions of the screw per minute, (slightly less than 64,) and a mean effective pressure of 13·31 pounds per square inch of pistons, (slightly less than 13·38 pounds,) there was developed by the engines sufficient power, (672·7 horses,) after overcoming the screw resistances of the front edges of the blades, and surface friction on the water, and engine resistances of friction and load on air pump, and also friction of load on the engines, to drive the vessel 7·25 knots per hour.

During the performance on the 2d of August, when the screw made 64 revolutions per minute, the above named screw and engine resistances may be considered practically the same as with 63 revolutions. The power now developed by the engines was 767·45 horses. But if the speed of the screw were now really less than the speed of the vessel, and retarding it by dragging, the screw would be assisted in its revolutions by the reaction of the water caused by that greater speed of the vessel; consequently there would not be required to be exerted by the engines, in order to overcome the screw and engine resistances, as much power as was required when making the 63 revolutions in the Thames river; yet the total power now developed by the engines was greater than before, viz: 767·45, instead of 672·7, while a less power than before was required to overcome the screw and engine resistances. What then has become of the large remainder of this power? It must have been expended on some resistance, and the only resistances opposed to the power of a steam engine, in propelling a vessel by a screw, are the screw and engine resistances, the friction of the load, and the resistance of the vessel itself. We have seen, however, that but a small portion of the power developed by the engines was absorbed in overcoming the screw, engine, and friction resistances; the remainder therefore must have been expended in overcoming the resistance of the vessel; that is, in propelling the vessel; notwithstanding that the vessel was *apparently* going faster than the screw, and could not therefore be propelled by it. A little attention to what takes place in the passage of a body through water, will reconcile the contradiction.

It is familiar to all, that when a body passes through water, it leaves a vacuity behind, which is filled by the inrushing water. It is impossible in any case, that this vacuity can be made and filled simultaneously; *time*

is required for the operation, and the effect of time is to generate a current, or give velocity to the inrushing water: for as the water falls into the vacuity by its gravity, the speed of its current or its velocity will be proportional to the time required for the water thus to fall in. No matter how fine the after lines of a vessel may be, or how slow its speed, it must have, when in motion, *some* following current, and this current will be in some proportion to the fineness of the after lines and the speed of the vessel. The finer the lines and the less the speed, the less will be the velocity of the following current, because less time will elapse before the following water will have fallen in; or in other words, the following water will have a less distance to flow before it fills the vacuity.

An illustration of the same thing may be had by observing the eddy at the back end of a bridge pier placed in a current of water. A chip thrown into the current at the front end of the pier, close beside it, will not be carried straight on, but will close in behind the pier, and remain at rest.

With a hull of the *Arrogant's* proportions, moving through the water at the high velocity of 10·60 knots per hour, it is very probable the following current had a considerable velocity, and as the screw acted in and against this following current, it might have had a very *positive* slip, comparing the speed of the screw with the vessel's speed diminished by the speed of this current; while it had a *negative* slip, compared with the vessel's absolute speed through the water, supposing no following current to exist, and that the vessel and screw moved through the water in the same condition.

If the water were passing the screw at the vessel's speed, it would pass at the rate of 10·60 knots per hour; but if there were a following current of say 1·60 knots per hour, the water would only pass the screw at the rate of 9 knots per hour. The speed of the screw should therefore be compared with the latter rate, which, if it could be ascertained, would give the *true* slip of the screw, a slip that would always be found a *positive* one.

It must here be distinctly remembered, that a negative slip can only happen when the vessel has a high speed, and owes a considerable portion of it to a power additional to that applied to the screw, that of the sails, for instance; though it has frequently been reported to exist, when the vessel was being propelled by the screw alone. In these cases, it was manifestly the result either of inaccurate observations of distance gone, and revolutions made, or of a mistake in the pitch of the screw, reckoning it less than it actually was.

Supposing the motion of the vessel through the water to leave no vacuity behind it, the resistance of the vessel would occasion a certain positive slip of the screw. Now, suppose this vacuity to exist, the bow resistance of the vessel would be increased by it, and by consequence the slip of the screw would be increased. Now, suppose also, that by reason of this vacuity, a following current be generated, which striking the screw diminishes again the increased slip; it is evident that this following current cannot impart *more* power than was absorbed in generating it; that is to say, that its additional resistance to the screw can only equal the additional resistance at the bow, thrown upon the screw by the genera-

tion of this current. Under the most favorable circumstances, then, the slip would remain the same, either with or without the following current; but in practice it cannot at all retain this equality, for the whole of the power bestowed in generating the following current, and resident in it, cannot be re-applied to the screw; in fact, but a small quantity can be so regained. To say, that in a vessel propelled by a screw alone, the vessel's speed could surpass that of the screw, would be to say, that in the case of a man wheeling a wheelbarrow, the speed of the wheelbarrow surpassed that of the man.

For the Journal of the Franklin Institute.

An Account of the Explosion of the Steamboat "Brilliant." By A. C. Jones, Esq., *Engineer.*

To the Committee on Publications.

Gentlemen:—Circumstances prevented my forwarding to you the account of the *last* explosion on the steamboat *Brilliant* at the time of its occurrence; it presenting some new features in recklessness, may even a this late day be acceptable to the readers of the Journal. As the same boat collapsed a flue last July, I will include both accidents (!) in this paper.

New boats are heralded with many safety contrivances; but not one states, (nor could many with truth,) that they have competent engineers. The advertisement of the new *Brilliant* ran thus:—"The Brilliant has more securities for the protection of passengers than any boat afloat, having the steam indicator, the water indicator, and in the event of fire, can flood the hold in an instant with steam, and is now offered to the public as the fastest boat on the river," &c.

The *Brilliant* was principally owned by planters on the "coast,"* and was intended to be one of the "crack packets;" from causes which it is not necessary to enumerate, she was not one of the "fast ones," unless the boilers were hard pushed; and to have this done, the captain being a "hot man," employed "*hot engineers.*"†

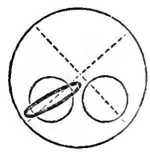
On the third trip, at 6 A. M., about five miles below the town of Plaquemine, the inboard flue of the larboard outside boiler collapsed, scalding several and killing four or five men. No injury was done to the boat.

This is an extract from a newspaper of the day:—"Captain Hart intends remaining here until a full judicial examination is had of the boilers, and the cause of the collapse. He has demanded the examination

*Both banks of the lower Mississippi river are so termed.

†This is the name applied to those miscalled engineers, whose rashness, coupled with ignorance, leads them to increase the pressure by overloading the safety valve, and by the hardest kind of firing, force the boat, at the risk of all on board, to go a little faster than their predecessors had done before. Strange to say, this worthless tribe bid fair to drive prudent engineers off the river.

before the U. S. Commissioner." Collapsing a flue being too trifling a matter for the attention of the Commissioner, no examination was had, and yet a proper inquiry might have led to the prevention of the last catastrophe, as the cause was similar in both cases, EXCESSIVE PRESSURE. On a personal examination, I found the flue collapsed its whole length, and partly torn from the boiler heads, (wrought iron.) The torn edges of the sheets presented a bright clean surface, and had every appearance of being soft and tough; the after sheet is slightly laminated, but on the whole is excellent iron.* The water line in the boiler showed that the water was flush at the time of the collapse; and this is borne out by the positions of the three gauge cocks, the lowest one being *four inches above the tops of the flues.* As they understood the true policy of carrying a good head of water, the cause is easily arrived at. The objectionable feature in most of the boilers on the river, is having the flues so large as to leave little water space between the flue and the shell. In this case, at the after end it is under $1\frac{3}{4}$ inches, and it may have been still less at intermediate parts between the heads. With hard firing, the heat acting on both sides of this film of water, causes it to be repelled, and the flue and shell along that line becoming overheated, and the flue being the weakest, prepares the way for a collapse, and sometimes an explosion. That this want of water space is a primary cause, is proved by the inspection of collapsed flues, where the water in the boiler was ample at the time of the flues giving way; eight out of ten are flattened in a line drawn from this contracted space through the axis of the flues, thus: the tearing or separation from the heads generally following the collapse.



The Explosion.—Some time after the collapse, new boilers of heavier iron were put into the boat, and the fall business commenced. Not yet being able to beat every thing on the river, (and the former collapse being forgotten,) caused a change of "*hot engineers*" from trip to trip. The last trip but one, the Captain employed at *extra wages*, "*the hottest man on the river*," as second engineer. This man was in charge at the time of the explosion.

On September 28th, 1851, about $8\frac{1}{2}$ A. M., while backing out from Dr. Stone's Plantation,† the second starboard boiler exploded as soon as the engines were put in motion. The killed and missing exceeded sixty persons.

A short period prior to the explosion, it was said by persons on board at the time, that the engineer on duty, in reply to the Captain's urging him to increase the speed, stated that the boilers would not bear more steam. All accounts agree that they had been firing as hard as they could,

*So far as the toughness of the iron is concerned, this will hold good; but it is of too soft a nature for flues. I am not aware of any experiments having been made on flues, to test their resistance to the crushing force tending to collapse; but it seems to be lost sight of, that hard stiff iron would be preferable to the soft Western iron plates generally used for flues.

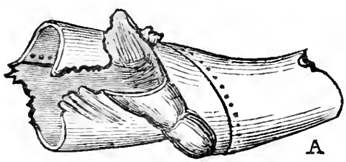
†This was likewise on a Sunday morning, and almost on the same spot where the former collapse occurred.

and using rosin freely at the time. *No steam was allowed to escape during the stop at the landing*, which was about four minutes.

There were five 42-inch boilers, with wrought heads, and 16-inch double flues, all being of heavy iron; the water space in these (like those they replaced,) was about two inches.

It appears that this boiler was torn asunder; the shell and part of the flues passing forward like a rocket over the starboard bow into the river; the remaining boilers are only displaced, the after ends having settled down; the doctor, steam drum, and pipes being slightly injured; the safety valve broken, and lever bent. Over and abaft the boilers, is a large breach in the cabin floor, through which passed a great quantity of water and steam, wetting every thing in the saloon to the after end of the ladies' cabin, much of the furniture being broken and destroyed. Twenty feet from the edge of the hole, lay two pieces of cast iron, being part of the flue return plate; fifteen feet further aft is the manhead, one bolt being broken; and near by is the lead gasket, which had formed the joint, and is crumpled up, but not melted. There were a few more fragments of iron on this deck.

Returning to the main deck, about five feet abaft the ends of the boilers, on the larboard side, partly across the boat, lay a piece of collapsed flue, doubled up in its length, so that its cross section has the form of a horseshoe, U. On the platform, alongside of the starboard engine, is a piece of flue, (see sketch,) about two feet long, partly collapsed; the end, A, having by some means become partly shaved by contact with other iron. I send you a small spinicle broken off the flue; it is of a beautiful pink and orange color, caused by friction; and with it two pieces of lead; the small piece was taken from the chock joint of the remaining starboard boiler; the largest piece of lead is part of the chock joint of the other side of the exploded boiler. The lead in these chock joints, and the pieces of flues, prove that it was not for want of water that the boiler gave way; but simply by the excessive pressure at the time, from the steam being kept in, *although making fast*, and probably being increased at the instant by filling the cylinder quickly with steam, thereby creating a shock, which caused this overstrained boiler to yield.



Both engineers being dead, not the slightest attempt has been made to bring the surviving master spirit to justice, for this wilful and wanton destruction of life.

P. S. I shall forward you in a few days, the last explosion of the tow-boat *Mary Kingsland.*

New Orleans, February 23d, 1852.

For the Journal of the Franklin Institute.

Queries, by Dr. Hare, *to* Prof. Espy, *or to Meteorologists in general, induced mainly by certain generalizations in Espy's Report to the Naval Department.*

Having been called on officially to give his opinions on Prof. Espy's labors, Dr. Hare has preferred to publish them in full, rather than resort to a brief epistolary juridical communication.

The subjoined generalizations are quoted from the quarto pamphlet, entitled Espy's Report on Meteorology, page 5.

1. "The rain and snow storms, and even the moderate rains and snows, travel from the west towards the east in the United States, during the months of November, December, January, February, and March, which are the only months to which these generalizations apply."

2. "The storms are accompanied with a depression of the barometer near the central line of the storm."

3. "This central line of minimum pressure is generally of great length from north and south, and moves side foremost towards the east."

5. "The velocity of this line is such that it travels from the Mississippi to the Connecticut river in about twenty-four hours, and from the Connecticut to St. Johns, Newfoundland, in nearly the same time, or about thirty-six miles an hour."

7. "In great storms, the wind, for several hundred miles on both sides of the line of minimum pressure, blows towards that line directly, or obliquely."

10. "Many storms are of great and unknown length, from north to south, reaching beyond our observers on the Gulf of Mexico and on the northern lakes, while their east and west diameter is comparatively small. The storms, therefore, move side foremost."

11. "Most storms commence in the 'far west,' beyond our most Western observers; but some commence in the United States."

13. "There is generally a lull of wind at the line of minimum pressure, and sometimes a calm."

Queries submitted for the consideration of Prof. Espy, before making his next Report.

1. Has not experience established that vessels in approaching the Atlantic coast of the United States, are liable to be subjected, in the first instance, to a violent south-easter, then to a calm, or lull, followed by a north-wester, no less violent than the gale first encountered?

2. Whether the gale of 1836, of which the phenomena were recorded by Prof. Loomis, and published in the Transactions of the American Philosophical Society soon after, does not exemplify the origin and progress of such gales, by showing that the wind blew from between north and west, towards an oblong area of minimum barometric pressure, on one

side; while it blew towards that area on the other side, from the opposite quadrant of the horizon, between south and east.

3. Whether the observations thus recorded, do not show that the area of minimum pressure moved gradually from the north-west towards south-east, subjecting every station successively exposed to it, first to a south-easter, then to a lull, and finally to a north-wester?

4. Whether the course of this storm was not from north-west to south-east; and whether it did not, in this respect, agree with the well known gales, or hurricanes, above adverted to as universally called south-easters?

5. These premises admitted, Mr. Espy is requested to explain wherefore in one of his generalizations, he alleges that storms travel from *West* towards the *East* during the five winter months, instead of alleging that they travel from north-west to south-east, consistently with the observations of Loomis above mentioned?

6. Whether, if the language of the generalization were accurate, all gales experienced on the United States coast, would not blow from due east first, and from due west afterwards?

7. Whether there is not another distinct kind of storm, long known and universally recognised as the "north-easter" or "north-eastern gale," which has been distinguished from the south-easter, so called, by its direction, its longer endurance, lesser violence, and by its not being usually followed, after a brief lull, by a north-wester; nor any violent wind in a direction directly opposite to that in which it blew at the beginning of the storm?

8. Whether, moreover, co-existent with this north-eastern gale, there are not always upper clouds, which are to be seen occasionally through openings in the rainy strata, which upper clouds move slowly from the south-west in a direction nearly opposite to that which the scud pursues?

9. Whether, agreeably to the observations of Franklin, and general experience confirming them, our storms producing north-eastern gales do not travel from south-west to north-east, so that they are perceived earlier as the place of exposure is more to leeward?

10. Whether their traveling thus, does not warrant the opinion that they commence in the Gulf of Mexico, and are propagated gradually to the north-east along the Atlantic States, and the neighboring portion of the Atlantic ocean?

11. Whether the observations of Redfield do not establish, so far as they are reliable, that certain storms travel from the Gulf along the coast of the United States, and of course from south-west to north-east; and how these results are to be reconciled with the generalization in the report, or with the evidence adduced by Loomis?

12. Whether any absurdity which Redfield's inferences involve respecting the interior phenomena of his suppositious whirlwinds, justify distrust of the correctness of the route which they are represented to have pursued?

13. Whether we are to admit a generalization, which agrees neither with Loomis, Franklin, nor Redfield?

14. How can the observations of Franklin, confirmed by a very gene-

ral impression that they were sagacious and well founded, be reconciled with those made by Loomis, also highly esteemed, unless there be two kinds of storms, one of which travels from the *north-west* to *south-east*, the other from *south-west* to *north-east*?

15. Whether it can be correct to confound both of these kinds of storms under the one generalization of "*Storms moving from west to east*?"

16. Whether there is any difference in the direction of storms during the warmer months, justifying the restrictions to the colder season, of the generalization that storms move from east to west?

17. Do not tornadoes always move, whether in summer or winter, from north-west to south-east?

18. Do not thunder gusts almost invariably move from west to east, usually from N. W. to S. E.?

19. Whether there is any coincidence as to time between the prevalence of the terrific Norther of the Mexican Gulf Coast, and that of our north-east gales?

20. Whether they are not both consequent to the displacement of the warmer air lying on the Gulf, by the colder air of the territory of the United States, north or north-east of the Gulf, to whatever cause that displacement may be due?

21. Whether simultaneously with the existence of the norther on the western coast of the Gulf, there *is*, or *is not*, a north-easter blowing from the United States territory eastward of the Allegheny ridge, into the aerial estuary over the gulf?

22. There being three different climates within the territory of Mexico, according to the altitude of the localities throughout which they prevail, the lower being designated as the hot region, the middle as the rainy region, and the upper or table land of the City of Mexico, as the mild and dry region; whether it is not evident that the clouds of the Gulf do not ever cross the table land; but by their access to the intermediate region, cause its characteristic humidity?

23. Whether in point of fact, the climate of the table land of Mexico and that of the Gulf, are not independent of each other, so that however an ascent of the air of a portion of the Gulf, may render an horizontal afflux to supply its place necessary, the effect will be to draw the whole supply from the lower and comparatively cooler territory of the United States, lying to the north and east of the Gulf?

24. Whether, as the area of the Gulf reaches to nearly two-thirds of the size of the Valley of the Mississippi, and the territory of the Atlantic States, it should not have a great influence on the winds of the United States, and whether it does not justify a doubt of the correctness of any sweeping generalization which does not admit that great estuary to have any influence?

25. Whether the prevalence of gales supposed generally to occur about the time of the Autumnal Equinox, may not be explained by this fact, that the decline of the solar heat in September, cools the land more than the seas by which it is bounded; whence it follows that at this season of terrestrial refrigeration, there will be greater propensity for the air over the land, to displace that of the adjoining seas; and whether this process is not likely to be peculiarly influential in the case of the Gulf of Mexico,

and the territory of the United States, thus creating an unusual tendency to the production of north-east gales about the time of the equinox?

26. Whether the north-eastern gale does not cease to be a rainy wind at a certain distance from the United States coast, and if so, at what distance does it become a dry wind, a harbinger of a cloudless sky?

27. Whether this diversity in the character of the north-easter, may not be fairly ascribed to the facts above cited in relation to the Gulf of Mexico, since when the gale in question blows into the basin of that estuary, the air displaced by it being incapable of surmounting the barrier made by the table land and mountains, so as to get off to leeward, it has to flow back over the inblowing gale, furnishing thus the moisture which forms its well known attribute?

28. Whether the fact that, beyond the range of our Atlantic coast, there is no such basin and barrier, is not the reason of there being no moisture associated with winds having a north-eastern direction, since in that case there is no barrier to cause the moist air displaced to flow in an opposite course above that of the displacing current below?

29. Whether the general tendency of the wind, in the upper region, to move from south-west to north-east, over the United States territory, does not fortify the idea that the warm and moist air, displaced from the Gulf, must pursue an opposite route to that of the lower wind, by which it may be supplanted?*

Queries respecting the conflicting explanations of the causes of Tornados and and Water Spouts.

The preceding queries are intended to draw attention to those points of view in which the generalizations of Prof. Espy are apparently irreconcileable with well known facts, extensive experience, or the observations of other meteorologists; but as the learned Professor mingles references to his theory incessantly with his observations, I request that he answer some queries bearing thereupon.

I therefore propose the following inquiries:

Whether there are not two well known modes of electrical discharge, by which bodies oppositely electrified are made to neutralize each other, in one of which, electricity passes in a spark, in the other, is conveyed from one surface to the other, by the motion of some intervening body; whence the alternate motion of clappers between bells, of pith balls, or puppets between disks, and of blasts of air from electrified points.

The existence of these modes of discharge being admitted, and also that one of them has been called the spark, or diruptive discharge, the other, the carrying or convective discharge. I ask whether any charge whatever, may not be neutralized either by the convective or diruptive process, so that the one is commutable for the other by a slight diversity of distance.

Whether in every case of the existence of an electric charge, attraction does not take place between the surfaces, or bodies employed to hold it?

* Prof. Espy may probably consider his generalizations as justified by the plotted record of his observations, but the examination of them has not created that impression. He has lectured and reported upon his own theory and observations, without bringing those of his predecessors or contemporaries sufficiently into view.

Whether it does not follow, that wherever there can be a charge competent to produce the diruptive spark discharge, there must be a competency to produce the convective discharge?

These premises conceded, and it being admitted that lightning is a diruptive discharge on a gigantic scale, does it not follow that there must be a gigantic convective discharge in nature upon a scale of commensurate magnitude?

Let Mr. Espy say where that convective discharge is to be found, if it be not in the tornado or water spout?

Let him say in what respect the features of the tornado are discordant with those of a convective electrical discharge?

Let him say why the phenomena observed by Allen, are not a magnificent illustration of the alternation of the convective and diruptive discharge?*

Is not Prof. Espy aware that the immediate mechanical causes of the devastation produced by tornadoes and water spouts, were never well ascertained prior to the observations made respecting the tornado of New Brunswick in June, 1835, especially by means of the survey made by Professor A. D. Bache and himself.

Moreover, that agreeably to the observations and survey alluded to, it was shown that tornadoes consist of an upward blast of air about the axis, and horizontal confluent blasts from all quarters to supply the upward blast, the axis having a progressive velocity?

While at that time, by Prof. Espy, the ascentional force was attributed to a buoyancy arising from the heat, evolved by aqueous vapor in condensing within the upper part of a rising column of air, was it not by me ascribed to a discharge of electricity between the earth and sky, and superseding the discharge in the form of lightning? Did not Mr. Espy know that this explanation was the subject of a memoir published in the transactions of the American Philosophical Society, in vol. v. 1836; subsequently published in Silliman's Journal, vol. xxxii, 1837?

As the volumes of the Society above mentioned are invariably sent to the Academy of Sciences, at Paris, soon after being issued, was not Prof. Espy aware that the volume containing my memoir must have been in the library of that academy, when in 1840 his theory was submitted to the committee appointed to report upon it.

In his book, entitled "Philosophy of Storms," an account is quoted from Peltier, of a tornado which occurred at Chatenay, near Paris, by which a chateau and its park were devastated. Was not Professor Espy informed that this account of Peltier was comprised in a report made under the following circumstances:

*The observations of Mr. Allen were stated in the following words:—"Being within a few yards of this spot, I had an opportunity of accurately noting the effects produced on the surface of the water. The circle formed by the tornado on the foaming water was about 300 feet in diameter. Within this circle the water appeared to be in commotion, like that in a huge boiling cauldron. The waves heaved and swelled, whenever the point of this cone passed over them, apparently as if some magical spell were acting upon them by the effect of enchantment. *Twice I noticed a gleam of lightning, or of electric fluid to dart through the column of vapor. After the flash, the foam of the water seemed immediately to diminish for a moment, as if the discharge of the electric fluid had served to calm the excitement on its agitated surface.*"

The chateau being insured against damage done by thunder storms, indemnity was claimed; but the insurers objected, that the tornado was not a thunder storm. Hence the question was referred to Arago, President of the Academy. This distinguished savan, being unable to attend personally, deputed Peltier; who, after an investigation of the phenomena, and examination of witnesses, adopted my explanation, so far as this, that the tornado, by intervening between the earth and sky, supersedes the more usual mode of discharge by lightning.

When the Professor was submitting his views to Mr. Babinet, was he ignorant of the following facts, which I afterwards learned from the parties themselves: that Arago was so occupied with business to which he was subjected by the Government and the Academy, that he could not give any attention to Prof. Espy's application; that Pouillet not agreeing with Babinet, and Arago not attending, left to Babinet exclusively to report upon the Espyan theory; and that Babinet, more distinguished as a profound mathematician, than as a well informed meteorologist, made his report in ignorance of the existence of my memoir, of Peltier's report, or the consequent judgment against the insurers?

Is it not evident, therefore, that the report made by Babinet, and signed by Arago and Pouillet, was obtained upon exparte representations hrough neglect and ignorance, and that either on the one hand, gross inustice had been done to the insurers in being made to pay for it as an electrical storm, or on the other, the report did injustice to the cause of scientific truth, in ascribing it to heat?

Is it not evident that when a balloon rises it is pressed up, by the wedging in under it of the heavier surrounding air, and that this, while it presses the balloon upwards, presses downwards on the column of air immediately under it?

If this be a true representation of the process by which a balloon is elevated, how could the ascent of a balloon, however great, at the level of the clouds, disturb the column of air supporting the balloon, so low down as the base resting on the terrestrial surface.

Does not this reasoning apply equally to a mass of air warmer than that surrounding it, in consequence of the latent heat yielded by condensation of the contained vapor?

Is not this the reason why the inflammation of a stratum of carded cotton above the mouth of an inverted open necked bell glass, produced not the slightest movement in fibres of the same material, situated on a wire gauze within the bell immediately over the bore of the neck?

Are not all the Espyan requisites for the production of a tornado to be found in the upward current of air over equatorial regions, by which the trade winds are induced? If so, wherefore does not a tornado prevail there, as enduring as that upward current?

Queries to Meteorologists generally.

The following queries are not made with any reference to Espy's theory or generalizations; but with a view to complete the series which has at this time been suggested to me as worthy of the attention of meteorologists.

Does it not follow that whenever any portion of the atmosphere is charged positively, or negatively, the aerial particles must undergo a corresponding rarefaction from the reciprocal repulsion consequent to a similar state of electrical excitement? May not this be one cause of a buoyancy and consequent ascentional power, producing a penetration of the region of frost, by the lower strata of the atmosphere?

Whenever electrical repulsion tends to counteract gravitation, is it not reasonable that barometrical pressure should be diminished, and may not oppositely charged aerial masses by rushing together, sustain a diminution of volume, and cause a precipitation of vapor as rain, by super-saturating the space within which they commingle?

If, as above suggested, a diversity of electrical excitement be followed by corresponding variations of the density of the air and of the space occupied by it; whenever by such means a dilatation of bulk occurs in a mass of the atmosphere, will it not take up any moisture to which there may be access sufficient to saturate the additional space occupied; and whenever the opposite change of diminution of volume ensues, will it not deposit a proportionable quantity of moisture?

Is not the action of the air in this respect in taking up and giving out moisture, analogous to that of a sponge, which absorbs or gives out any surrounding liquid, accordingly as it may be allowed to dilate by its own elasticity, or made to contract by mechanical compression?

May not each globule of water in a cloud be inflated with air like a bubble, while this bubble may be expanded by electrical repulsion, so as to be more buoyant, than if it were electrically neutral, and may not this be one cause of the buoyancy of clouds?

May not a buoyancy thus arising, be one source of ascentional power inducing those upward currents which cause rain?

It is well known that clouds intercept the radiant heat given off by the terrestrial surface to such an extent, that white frost, which is always the consequence of radiation, only takes place when the sky is clear. Does it not follow that the clouds must acquire heat by terrestrial radiation, so that the air with which they are associated must consequently be made warmer and more buoyant than it would otherwise be?

Have we not reason, then, to infer, that the heat arising from terrestrial radiation is one of the causes of the buoyancy of clouds?

Nevertheless, generally, is not the persistence of clouds only apparent? Are they not formed as the vapor, in any rising column of air, reaches the level where there is sufficient refrigeration to condense it; but is not the cloud thus formed, dissolved usually by the air above, of which the dew point is so low as to enable it to take up the precipitated vapor?

Are not the phenomena analogous to those of the fog or cloud, which may appear to surmount *persistently*, the escape pipe of a steamboat boiler, although this is manifestly the effect of a successive condensation of succeeding portions of the aqueous vapor?

Dimensions and Computations of the Pittsburg and Cincinnati Packets, and some of the other large Steam Vessels which navigate the Ohio River, above or below the Falls, extracted from the Report of Proceedings in the matter of the Wheeling Bridge Case; being a portion of the Report of WM. J. MCALPINE, Esq., C. E., *to* HON. R. H. WALWORTH, *Commissioner of the Supreme Court of the United States.*

PARTS MEASURED, in feet and in decimals of a foot.	Pittsburg and Cincinnati Packets.							Louisville and Cincinnati Packets.		Louisville and New Orleans Steamboats.				Steubenville and Wheel'g Packet.	Louisville and Frankf't Packet.
	Clipper No. 2.	Brilliant.	Keystone State.	Buckeye State.	Messenger No. 2.	Cincinnati.	Hibernia No. 2.	Ben Franklin.	Telegraph No. 2.	Bostona.	Alex. Scott.	Peytona.	Magnolia.	Cabinet.	Blue Wing, No. 2.
Lengths—															
Stem to stern	215·	227·	250·	264·	244·	242·	226·	255·	..	265·	266·	265·	295·	172·	153·
Stem to promenade deck	28·	28·	28·	28·	29·	28·	28·	..	..	25·	26·	28·	35·	27·	21·
Stem to boilers	59·	71·	73·	81·	71·	73·	73·	80·	..	75·	82·	83·	88·	55·	40·
Stem to wheelshaft	145·	157·	162·	172·	160·	157·	152·	165·	..	173·	169·	177·	186·	129·	108·
Of pilot house	9·	8·	8·	10·	8·	8·	8·	11·	..	12·	10·	14·	16·	..	10·
Breadths—															
Of beam	32·	32·	30·	30·	31·	31·	28·	34·	..	34·	34·	33·	35·	27·	27·
Outside of guards	54·	58·	57·	56·	58·	55·	54·	66·	..	66·	69·	69·	72·	..	37·
Of pilot house	15·	15·	12·	12·	12·	12·	14·	13·	..	14·	13·	13·	16·	..	10·
Depth of hold	6·9	7·5	7·2	7·8	7·2	7·4	7·	7·	..	7·5	8·	8·	9·	5·6	5·7
Draft when light	3·2	3·5	3·3	3·5	2·9	3·3	3·5	..	3·5	4·7	3·8	..	4·4	1·8	2·7
Heights above the surface of the water when light—															
Main deck	4·4	4·0	4·3	4·5	4·2	4·3	3·5	3·3	4·2	3·5	4·	4·3	6·0	..	3·7
Promenade deck	16·8	16·	16·	16·	15·	16·	14·5	15·	17·8	15·8	16·3	18·3	21·3	..	10·
Hurricane deck	22·3	23·6	25·	23·8	22·5	23·	19·5	24·5	27·	26·5	27·	26·5	30·	..	21·
Skylight deck	25·9	26·1	27·7	26·	25·2	25·5	22·	28·7	31·2	29·	29·5	29·8	34·2	..	23·
Pilot house	45·1	46·3	46·1	45·7	45·4	45·8	40·5	48·6	50·4	49·5	50·1	43·8	56·7	..	32·5
Wheel house	26·7	30·7	30·3	30·8	28·4	32·0	24·2	29·5	32·3	30·2	34·5	32·	41·5	..	24·

Cross braces	28·7	..	27·7	34·1	26·8	26·7	43·5	29·5	..	29·5	32·	30·8	38·2	..	25·3
Hog chain braces	..	51·4	..	52·4	..	..	..	..	..	..	..	..	..	..	..
Paddle Wheels—															
Diameter	25·	29·5	30·	31·3	30·	32·6	26·	27·5	30·	30·	30·	30·	40·	22·	25·
Diameter of shaft	1·	1·3	1·3	1·4	1·3	1·3	..	..	..	1·3	..	..	1·5	..	..
Length of bucket	11·3	11·4	12·	11·5	12·	11·	12·	14·7	12·	14·	15·	16·	12·2	8·3	7·
Width of bucket	2·	2·2	2·7	2·6	2·5	2·3	2·6	3·	3·	2·5	2·3	2·5	2·4	2·2	2·
Number of sets of arms	16·	20·	19·	20·	18·	18·	18·	18·	18·	18·	20·	18·	26·	15·	14·
Revolutions per minute	22·	20·	19·	18·	19·	18·	19·	16·	18·	20·	18·	16·	16·	24·	23·
Chimneys—															
Centre of flues ab. surf. water	9·7	9·5	9·5	10·	9·7	9·8	8·1	8·6	9·5	8·6	9·2	9·8	12·	8·2	8·3
Hinges " "	54·5	59·	27·	26·8	64·	28·9	53·7	..	..	..	..	..	..	..	23·6
Top of, " "	66·7	71·5	77·5	74·8	71·	81·7	63·7	72·7	79·8	85·8	87·5	73·8	90·4	56·	55·6
Top of, above flues	57·0	62·0	61·0	61·8	61·3	66·9	55·6	64·1	66·3	77·2	76·3	61·0	78·4	47·8	47·3
Distance between chimneys	..	18·5	18·	..	..	17·8	15·3	..	..	..	..	..	..	..	..
Diameter of	3·66	4·55	4·96	5·50	4·15	4·45	4·5	4·6	4·85	4·75	5·	5·1	5.	..	3·55
Width of iron rings	2·04	2·07	2·17	2·06	2·04	1·75	2·0	2·0	2·0	1·92	2·	1·83	2·0	..	3·56
Boilers—															
Number	4·	5·	4·	5·	5·	4·	5·	6·	5·	5·	6·	6·	6·	2·	3·
Length	26·2	26·5	30·8	30·2	30·	28·	27·	32·	30·	34·	31·	32·5	30·	26·	22·
Diameter	3·08	3·33	3·45	3·5	3·37	3·33	3·42	3·33	3·33	3·5	3·5	3·5	3·5	3·5	3·33
Distance from centre to centre	3·7	4·	4·1	4·2	4·2	4·1	4·	3·7	4.	4·	4·2	4·2	4·1	4·	4.
Number of flues	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·
Diameter of flues, inside	1·08	1·29	1·45	1·15	1·33	1·27	1·17	1·17	1·33	1·33	1·21	1·25	1·33	1·33	1·25
Draft space, back end	0·83	0·70	1·00	0·75	0·90	1·00	0·90	0·92	0·75	0·75	..	..	..	..	..
Draft space, over bridge	0·42	0·42	0·5	0·61	0·60	0·58	0·50	0·50	0·70	..	..	..	0·83	0·46	..
Pressure of steam, in lbs.	150·	140·	140·	140·	150·	150·	150·	130·	160·	145·	140·	125·	125·	135·	130·
Heaters—															
Number	1·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	1·
Diameter	2·	2·7	2·9	2·9	2·7	2·3	2·5	1·7	2·	2·5	2·3	2·	2·9	1·5	2·2
Length	4·	8·2	8·2	10·5	10·2	8·3	7·5	6·	6·	6·	8·	8·	8·	5·	6·3
Grate Bars—															
Length	4·	4·	4·	4·1	4·1	4·	4·	4·	4·	4·	4·1	4·1	4·	4·1	4·
Thickness	0·07	0·06	0·06	0·08	0·09	0·07	0·07	0·12	0·12	0·17	0·11	0·17	0·06	0·17	0·12
Spaces, width of	0·07	0·07	0·07	0·08	0·08	0·07	0·16	0·08	0·08	0·06	0·08	0·06	0·06	0·11	0·08
Depth of, below boiler	1·75	1·51	1·62	1·58	1·50	1·67	1·67	1·83	1·67	1·67	1·83	1·75	2·	1·04	1·67

PARTS MEASURED, in feet, and in decimals of a foot.	Clipper No. 2.	Brilliant.	Keystone State.	Buckeye State.	Messenger No. 2.	Cincinnati.	Hibernia No. 2.	Ben Franklin.	Telegraph No. 2.	Bostona.	Alex. Scott.	Peytona.	Magnolia.	Cabinet.	Blue Wing, No. 2.
Engines—															
Number of cylinders	4·	2·	2·	2·	2·	2·	2·	2.	2.	2·	2·	2·	2.	2·	2·
Diameter of do.	1·33	2·19	2·12	2·42	2·33	2·	2·33	2·50	2·17	2·21	2·08	2·50	2·50	1·42	1·46
Length of stroke	7·	8·	8·	8·	7·50	7·	8·	8·	9·	9.	10·	10·	10.	5·50	7·
Cuts off at	5·25	4·	3·5	5·	4·6	3·5	5·	4·	6·75	5.	6·25	6·25	6·25	2·75	4·38
Length of connecting rods	21·	26·	26·	26·	26·	26·	21·	26·	27·	29·	30·	30·	35·	20·	22·
Size of steam ports, in sq. ft.	..	..	..	0·2552	..	..	0·1872	..	..	..	..	..	0·3886	..	·1512
" escape ports	..	..	..	0·3984	..	..	0·2988	..	..	..	..	..	0·4814	..	·1800
Diameter of steam valves	0·33	..	..	0·56	0·50	..	..	0·58	0·62	0·54	..	..	0·71	0·33	..
" escape valves	0·16	..	..	0·62	0·58	..	..	0·67	0·71	0·62	..	..	0·79	0·43	..
" steam pipe	2·	2·	2.	..	..	..	..	..	..	..	..	..	..	..	..
" branch pipes	0·40	0·67	0·56	0·65	0·65	0·50	0·65	0·65	..	0·67	0·67	0·70	0·67	0·34	0·50
" exhaust pipe	1·00	0·90	1·10	1·10	1·10	0·80	1·10	1·00	1·00	0·9	1.00	1·20	1·00	0·50	0·80
Engines to work pumps—															
Diameter of cylinder	0·75	1·00	..	0·75	0·75	0·92	0·67	0·75	0·75	0·67	0·75	0·50	0·92	0·58	0·58
Stroke of do.	2·00	1·50	..	1·83	1·50	1·25	1·83	1·42	1·75	1·42	3·00	1.58	2·25	1·25	
Number of cold water pumps	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
Diameter of do. do.	0·46	0·46	0·52	0·54	0·50	0·48	0·42	0·58	0·44	0·46	0·67	0·46	0·58	0·33	0·37
Stroke of do. do.	..	..	..	1·42	1·29	1·50	1.00	1·50	1·75	1·17	2·00	1·58	1·67	0·71	
Number of hot water pumps	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
Diameter of do. do.	0·46	0·46	0·52	0·50	0·50	0·48	0·42	0·33	0·42	0·37	0·37	0·33	0·50	0·29	0·29
Stroke of do. do.	..	..	..	1·42	1·29	1·50	1·00	1·50	1·75	1·17	2·00	1·58	1·67	0·71	
Fuel consumed per trip—															
Coal, bushels	3200	4000	3000	4000	3000	3000	2500	..	..	..	..	..	..	100.	
Wood, cords	None.	50	72	50	60	20	80	..	..	660					
Average speed—															
Passage down, hours	36	36	36	30	42	38	40	9	10	132	144	..	..	3	
Passage up, do.	52	52	52	50	52	52	52	15	15	132	144	..	..	3	
Against four mile current	10	10	10	12	9	10	10	10	12	12	11	..	..	7	
Time boat commenced running	1848	1846	1850	1850	1848	1850	1847	1848	..	1848	..	..	1850	..	1850
Tonnage, carpenter's measur't	452·1	525·8	516·4	617·2	526·0	535·3	429·1	591·1	..	481.	710·	686·4	918·4	244·2	216·9

Sectional area, in sq. feet—															
Of immersion when light	96·4	107·6	94·1	102·7	82·85	..	94·0	..	..	153·9	123·3	..	150·0	46.6	68·7
Of two chimneys . .	20·82	32·24	38·32	47·00	30·82	30·82	31·38	33·10	36·66	34·70	38·64	40·36	..	..	19·58
Of all the flues . . .	7·36	13·00	13·20	16·70	13·90	10·08	10·80	12·96	13·90	13·90	13·80	14·76	16·68	5·56	7·38
Over bridge wall . .	17·06	22·72	20·25	26·95	..	22·73	..	28·12	24·62						
Area in square feet, of—															
One bucket of wheel .	22·66	25·69	33·00	30·70	30·00	25·63	32·01	44·25	35·04	35·00	34·95	40·00	29·61	19·16	14·16
Grate surface . .	59·2	80·	65·6	86·1	86·1	65·6	80·	88·8	80·	80·	93·32	93·32	98·40	32·80	48·
Spaces in grate . .	28·36	41·64	36·25	41·16	39·11	..	53·9	23·92	30·93	20·52	41·41	25·66	47·80	12·02	18·13
Whole heating surface .	1313·	1927·	1935·	2394·	2270·	1614·	1887·	2619·	2218·	2560·	2667·	2839·	2716·	786·	917·
Contents, cubic feet—															
Between grate bars and boilers	127·	160·	137·	176·	173·	139·	170·	199.	170·	173·	238·	230.	243·	46·	99·
Boilers, for water and steam	569·	775·	718·	914·	889·	669·	919·	1217.	858·	1125·	1320·	1353·	1191·	347·	398·
Ratio between—															
Buckets & immers'n of vessel	2·13	2·09	1·43	1·67	1·38	..	1·47	..	..	2·20	1·76	..	2·53	1·22	2·43
Grate and effective heating surface	1 to 14·80	1 to 15·54	1 to 18·90	1 to 17·81	1 to 16·92	1 to 15·91	1 to 15·47	1 to 19·49	1 to 17·82	1 to 20·79	1 to 16·96	1 to 17·99	1 to 17·92	1 to 15·55	1 to 12·77
Contents of boiler and effective heating surface	1 to 1·53	1 to 1·60	1 to 1·73	1 to 1·68	1 to 1·64	1 to 1·56	1 to 1·35	1 to 1·42	1 to 1·66	1 to 1·48	1 to 1·33	1 to 1·37	1 to 1·48	1 to 1·47	1 to 1·54
Distance traversed by hot air and gases . . .	107·	112·	123·	122·	121.	120·	107·	125·	123·	142·	135·	126·	135·	97·	88·
Fuel consumed in pounds of coal and its equivalent in wood,															
Per hour	2515·	3892·	3109·	1281·	3032·	..	2989·	..	..	3125·	..	..	..	1166·	
Per second . . .	0·71	1·08	0·95	1·19	0·84	..	0·83	..	..	0·87	..	..	..	0·32	
Per hour on each square foot of grate surface	43·	48·65	51·97	49·72	35·22		37·37	..	..	39·06	..	..	..	35·57	
Nominal horse power of all the engines—															
At 100 lbs. steam, per inch	800·	781·	659·	928·	866·	514·	913·	816·	895.	927·	862·	1104·	1104·	267·	378·
At pressure of steam, stated by engineer of boat .	1200·	1093·	922·	1300·	1212·	720·	1279·	1060·	1432.	1344·	1207·	1324·	1380·	360·	491·

For the Journal of the Franklin Institute.

A Series of Lectures on the Telegraph, delivered before the Franklin Institute. Session, 1850–51. *By* Dr. L. Turnbull.

Continued from page 284.

Improvements in Electro-Telegraphic Apparatus and Machinery. Wm. Thomas Henley, and David George Foster, of Clerkenwell, London, January 10th, 1849.—The invention consists, *Firstly*, in certain improved arrangements of electric apparatus, whereby a visible index hand or pointer is directly acted upon by a single magnet suspended within the sphere of influence of an electro or other magnet, having each of its extremities converted or resolved into two or more poles.

Secondly, Our invention consists in keeping the magnetic bar, needle, or pointer in one position for any length of time, or imparting to such bar, needle, or pointer, any number of distinct deflexions or movements, by means of the current or currents derived from magneto electricity, and also in making use of the residual magnetism to act upon the needle on its return to its stationary position, instead of the force of gravity; that is to say, in moving the needle in one direction by the induced current, and bringing it back to its stationary position by the action of the reversed inductive current, whereby the motions of the needles are increased in rapidity, and rendered much more marked and distinct than heretofore.

Thirdly, Our invention consists in certain improved arrangements of the magneto-electro apparatus used in electric telegraphs, whereby two distinct currents may be derived from the same magnet, and the reversed current can be made of equal intensity with the primary induced current, and single or double currents may be sent, as required, through any required number of instruments at different stations.

Fourthly, Our invention consists in the improved apportionment of the signs or symbols used in electric telegraphs. [The object of this new apportionment is to reduce the number of movements requisite, and it seems very successfully carried out. We pass over the details, which would occupy more space than we can afford to them.]

Fifthly, Our invention consists of an improved compound of gutta percha, suitable for the insulation, covering, and exterior protection of wire and other metallic substances employed to transmit currents of electricity. We mix the gutta percha nearly in equal portions, by weight, with sand which has been ground or pounded to a degree of fineness exceeding that of the finest natural sand, or with the siftings of glass paper manufactories, or glass fragments and particles of any sort, reduced to a similar degree of fineness, and this either by mixing the pulverized sand or glass with the gutta percha in a state of solution, or while in a plastic state.

Sixthly, Our invention consists in the employment of a current reverser of a peculiar construction, whereby we are enabled to dispense with the use of magneto apparatuses for the purpose of deriving currents of electricity in the manner before described, and to substitute in lieu thereof, voltaic batteries, such as are commonly in use for the purpose of transmitting currents of electricity along metallic conductors, such reverser

completing the circuit twice during its motion, by the transmission of a reversed current, in the manner of the magneto machines.

Seventhly, Our invention consists in the employment, in manner following, of currents of electricity to regulate and govern the motions of time-keepers, whether the same be influenced by a current from a distant station or otherwise. We make use for this purpose of the currents of either magneto or voltaic electricity; but obtained in the latter case without the aid of soft iron from two hollow coils of insulated wire affixed to the pendulum of the regulator, and surrounding the poles of two permanent horse-shoe magnets, which coils vibrate in the direction of their length alternately, off one pole on to the other, a current being induced at each vibration, but in opposite directions.

Claims.—1. We claim in respect to electric telegraphs, and to all machines or machinery, to the moving of which electricity is or may be applied, the different arrangements of apparatus described under the first head of this specification, in so far as respects the division of each pole of the magnet into two or more poles, and the direct action on the index hand or pointer, or other recipient of the magnetic influence.

2. We claim the mode of causing the index hand or pointer to be permanently deflected (that is, for any length of time required) in one direction, and bringing it back by the reversed current to its original stationary position, and keeping it there, as before described.

3. We claim the three several magneto-electric apparatus described under the third head of this specification, in so far as regards the peculiar arrangements and combinations, whereby two distinct currents are obtained from the same magnet, the reversed current is obtained of equal intensity with the primarily induced current, and either single or double currents may be sent as required through any number of instruments at different stations.

4. We claim the improved system of visible symbols suitable for electric telegraphs, before described and exemplified.

5. We claim the employment in electric telegraphs, and in all other machines and machinery to the moving of which electricity is applied, of the peculiar compound of gutta percha, before described, for purposes of insulation and protection.

6. We claim the improved current reverser, before described, in so far as respects the effecting by a single depression of the lever or key, the completing, reversing, and breaking of the electric current.

7. We claim the application of currents of magneto-electricity to regulate the motion of time-keepers in the peculiar manner described under the seventh head of this specification; that is to say, in so far as regards the obtaining of the currents from the inductive action of permanent magnets and coils of insulated wire without the aid of soft iron. And,

8. We claim the application to the regulating of time-keepers of currents of electricity (whether magneto or voltaic) transmitted from a primary or standard clock by the improved apparatuses and instruments, and by the peculiar modes before described, that is to say, in so far as regards the alternate transmission of the current in opposite directions, and the different mechanical arrangements whereby that is effected.—*London Mech. Mag.*, *Vol. L*, *p.* 148.

Henley's Magneto-Electric Telegraph.—An experiment has been made under the direction of the French Government, to test the efficacy of Mr. Henley's Magneto-Electric Telegraph, which is worked without batteries of any kind, and at a fraction of the cost of the voltaic system. The line of railway assumed for the trial was that from Paris to Valenciennes. The persons present at the two stations were, the director of the French telegraph, a Commissioner appointed by the Belgian Government, and a few others. The distance is 180 miles, being the longest telegraph line in France. After a most satisfactory series of trials on the single distance, first with full power, and afterwards with one-twentieth of the power, the wires were connected so as to treble the total length of wire, making 540 miles to and from Paris and back; the magnetic message being communicated through the first wire, back by the second, through the third, and back again by the earth. It was not anticipated that the magnet could possibly work through this resistance; but in fact, it is alleged it was worked as directly and rapidly as when only made to traverse the 180 miles with full power. The ordinary telegraph, with battery power, used by the French Government, was then put in requisition, but not the slightest effect was produced. On the single distance even, a signal was not obtained for several minutes, owing, it is said, to some fault in the batteries. The Government officers and others inspecting the working operation, expressed themselves thoroughly satisfied with the series of trial.—*London Mining Journal*, 1850.

Highton's Improvements in Electric Telegraphs.—On February 7, 1850, Mr. Edward Highton, Engineer, Middlesex, England, patented the following arrangement of telegraphic circuits: "Two or more signalizing instruments, and to each instrument two batteries are connected, so placed in regard to their poles as to work in opposite directions. A method of working electric telegraphs by the inductive influence of electro-magnets, making the dials, which carry the letters or characters, movable, instead of the pointers. As many of his claims are old, I only notice such as are important: he incloses his wires in flexible materials, such as lead; this was done in 1844, by Prof. Morse. The protecting the telegraphic wire by enveloping them in masonry; also, enameling the exterior surface of gutta percha coating of electric wires by rubbing the surface over with naphtha, or other solvents, and then smoothing it down by a cushion or brush.

A method of constructing the supporting posts out of a number of planks firmly united together, instead of out of one piece of timber, cut taperingly, as has hitherto been the custom.

Removing the atmospheric electricity which is collected during storms or other atmospheric disturbances, by causing the line wire, or a bar of iron connected thereto, previously enclosed in bibulous paper, or other fabric, to pass through a mass of iron filings.—*London Mech. Mag., No.* 1413, *Sept.* 1, 1850.

Brown and Williams's Improvements in Electric and Magnetic Telegraphs, March 17, 1850.—The only new claim is a method of protecting the conducting wires of electric telegraphs by strands of hemp put on by a braiding engine, and then coating the whole by gutta percha. And a method of connecting the transmitting wires by screwing one end of a

wire into a nut formed on the corresponding end of the next wire.—*Lond. Mech. Mag., March* 7, 1850.

W. S. Thomas's Improvements in Electric Telegraphs, patented Feb. 12, 1850. *Claim.*—What I claim as new is, the making of signals or marks for telegraphic purposes, by the agency of heat generated, induced, or controlled by a current of electricity passed along attenuated conductors, wires, or points; the signals being the flashes of light emitted by the heated conductor or points, are manifest to the eye of the operator; the marks being produced on the paper by the heated point or conductor are the record of the message.—*Journ. Frank. Inst., Sept.* 1850.

Mr. J. L. Palvermacher, C. E., of Vienna, Improvement in Galvanic Batteries, in Electric Telegraphs, and Electro-Magnetic and Magneto-Electric Machines.—I only notice his improvements in electric telegraphs, that is to say, in so far as regards, 1st, A method of varying the intensity of the current, either by increasing or diminishing the number of elements employed, or by interposing more or less powerful resistance to the current. 2d, The imprinting letters or signs by one completion of the current. 3d, The substitution of a letter cylinder for the letter wheel ordinarily employed, and a method of arranging the letters and signs on each cylinder. 4th, The application of a double escapement, each capable of assuming four directions, and each producing effects different from those produced by the others. 5th, The employment of four electro-magnets, to act on two soft iron bars, and thereby render a weak galvanic current, available in two directions, and productive of two separate and distinct effects. And, 6th, The method of gradually detaching the keeper from the electro-magnet, by causing the springs which act upon the keeper magnet, to come only successively into operation.—*Lond. Min. Journ. Vol. XX, p.* 323, *July*, 1850.

Mitchell's Electric Telegraph.—At a recent meeting of the Philosophical Society of Glasgow, Alexander Mitchell, in a lecture on the electric telegraph, introduced some improvements stated to have been made by him in the general arrangement of the instrument, in the use of only one wire, and in the great facility by which the instruments can be worked. As given in a Glasgow paper, it appears that letters are arranged in a segment in front of the operator, and corresponding ones inscribing on keys similar to those of a piano-forte. On pressing down a key, the corresponding letter is immediately pointed to by a needle, a similar movement taking place at every station throughout the circuit. We know not if Mr. Mitchell was the first constructor of this kind of telegraph, but we do know that a similar one was exhibited two years since at the Society of Arts; and we also know that several inventors of telegraphs have been content to use only one wire, employing the earth for the return circuit.—*Lond. Mining Journ. Vol. XX, April* 13th, 1850.

Austin F. Park's Improvements in Electric Telegraph Manipulators, Troy, New York, August 27, 1850.—"The nature of my invention consists in arranging machinery for closing and breaking an electric telegraph circuit in transmitting intelligence, whereby the operator, by giving a finger key one instantaneous touch, as distinguished from the prolonged touch applied to the key in ordinary machines, closes and breaks the

electric circuit, at and during such time as is required to signal or record a telegraphic sign for a letter, figure, or other character."—*Journ. Frank. Inst., Vol. XX, p.* 245.

The machine is stated to be ingenious, but unfortunately it is too complicated; the advantages of its use are to prevent mistakes from being made by telegraphic operators. I have not given the claims, as it could not be understood without a drawing.

Charles S. Bulkley's Improvements in Repeaters for Electro-Magnetic Telegraphs, Macon, Bibb Co., Georgia, Nov. 12, 1850: *Claim.*—"What I claim as my invention is, the manner of connecting two galvanic circuits with the two electro-magnets, (*a a*, and *d d*, in the said repeater,) each of the said galvanic circuits, as it passes through my said telegraphic repeater, embracing in its course the armature of the opposite electro magnet, in the said instrument, previous to its passing through the helices in the electro-magnet, embraced in its own respective circuit.

"In combination with the above, I also claim the connecting the points with the galvanic battery (or batteries), when the said points are placed in such positions in relation to the armatures of the electro-magnets in my said telegraphic repeater that when either one of the said electro-magnets is charged, it will, by attracting its armature against one of the points *l* or *i*, close the poles of the galvanic current in which the opposite electro-magnet (in the instrument) is in connexion, and thereby throw the battery into said circuit."—*Journ. Frankl. Inst., Vol. XXI, 3d series.*

The object of this repeater is for the purpose of repeating or recording a communication in several places at once along a line, and at the same time allowing the galvanic circuit to remain open when the line is not in use.

Siemens' Improvements in Electric Telegraphs.—Ernst Werner Siemens, of Berlin, patented in England, April 23, 1850, the following improvements: *Claims.*—"1st, The constructing electro-magnets for telegraphic purposes, of longitudinally divided tubes of iron or other magnetic metal, or of bundles of wire of iron or other magnetic metal.

"2d, The construction of instruments, for obtaining motion for telegraphic purposes, by means of one or two-electro magnets revolving on their axes within the fixed coils, by which they are rendered magnetic, or mounted on a transverse axis, and vibrating from side to side within the coils, by which they are magnetized.

"3d, The construction of instruments for producing motion for telegraphic purposes by means of metallic spiral coils or bands traversed by electric currents, and attracting or repelling each other; also producing motion in such spirals by the proximity of permanent magnets, which at the same time serve to produce electric currents by induction for working telegraphic apparatus.

"4th, The construction of the conducting contact pieces of alloys of platinum, iridium, or palladium with gold or silver, whether such alloys be further alloyed by the admixture of other metals or not.

"5th, The construction of electric telegraphic printing apparatus in such manner that the magnet which works the step by step motion, breaks and restores the circuit by the oscillation of the armature, or of the moving magnet itself.

"6th, The combining of electric telegraphic printing apparatus in the

same circuit with indicating apparatus, when the magnets which work the step by step motion of either or both instruments break and restore the circuit by the oscillation of the armatures, or of the magnets themselves.

"7th, The impression of the types on the paper at the instant that the type-wheel stops, by arranging the electro-magnet which acts on the hammer, so that the short intermittent currents which work the electro-magnet of the type-wheel traverses the coils of this magnet without producing motion of the armature, which, however, is set in motion when the current is rendered continuous by the stoppage of the type-wheel.

"8th, The arrangement of the magnet which acts on the hammer in electro-telegraphic printing apparatus, so that its own circuit is broken by the magnet itself towards the end of its stroke.

"9th, The arrangement of apparatus in electric printing apparatus in such manner that the printing is effected by pressing the type against paper, in contact with an inked roller.

"10th, An arrangement for retaining the moving piece which breaks and restores the electric circuit in its respective positions.

"11th, The application of a small pin for preventing the overrunning of the ratchet-wheel in electric telegraphic apparatus, with the step by step motion.

"12th, The arrangement of a transmitting apparatus with an indicating or printing electric apparatus worked by step by step motion, or with both together, in such manner that the transmitting apparatus breaks and restores the circuit of the telegraphic apparatus, which reciprocally breaks and restores the circuit of the transmitting instrument.

"13th, The combination of a self-acting alarum, with a transmitting apparatus.

"14th, The combination of a self-acting alarum with a transmitting instrument, which breaks and restores the circuit of the alarum magnet, which in its turn reciprocally breaks and restores the circuit of the transmitting instrument.

"15th, The combination of one or two cylinders carrying pins, with a series of springs and keys, for making contacts for transmitting a distinct determinate succession of electric currents in one or both directions by the depression of each key.

"16th, The employment of an implement of the nature of a plough, and revolving cutters for making trenches or channels to receive under-ground line wires.

"17th, The application of the propelling power of a locomotive engine to giving motion to such implements.

"18th, Conducting under-ground line wires into the ground, by means of suitable guides, which either form part of, or immediately follow, the cutting instruments.

"19th, The following improvement in the manufacture of coated wire for electric telegraphic purposes: first, an arrangement of machinery for coating the wire, with two cylinders and pistons, by which the pressure of the semi-fluid mass against the wire is equalized; 2d, arranging these cylinders, (or cylinder when only one is used,) so that they may be removed and replaced by others, while the former are being discharged;

and 3d, the consolidating of gutta percha, or its compounds within these cylinders in vacuo.

"20th, The testing of coated wire for telegraphic purposes, by passing it through water, with which is connected an apparatus capable of producing electric shocks, so that the circuit may include the person of the operator, and may be completed by the passage of the electricity through the defects in the coating in the wires.

"21st, The covering of insulated under-ground line wires with strips of sheet lead.

"22d, Establishing a direct communication between under-ground line wires and the earth, by means of a thin wire of German silver, or some other imperfectly conducting substance, so that the resistance to the passage of the electricity may be capable of being regulated at pleasure. *London Mechanics' Magazine, No.* 1421, *Nov.* 2, 1850.

An interesting report of M. Siemens' telegraph to the Academy of Science, Paris, will be found in vol. xxi, Third Series, of this Journal, p. 209 and 255-15, 1850.

The commission conclude their report of M. Siemens' apparatus in the following words: "The commission have examined M. Siemens' apparatus with great interest, and remarked throughout, an evidence of a perfect intelligence of the theory, as M. Siemens appears to have taken into account all the complicated phenomena which are manifested in the conductors and electro-magnets, especially when the actions are of short duration.

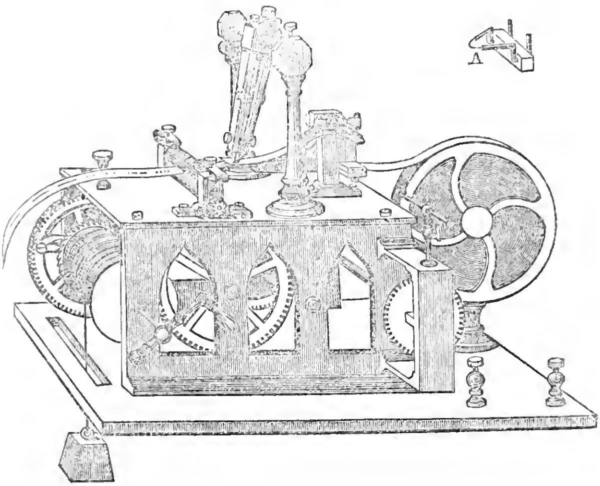
M. Siemens' system, if worked with care and attention, appears to possess incontestible superiority over all other apparatus of the like nature, that is to say, the ordinary arrangement of alphabetic apparatus; as the latter do not work with the same degree of precision and accuracy. With regard to speed, the commission are led to believe that M. Siemens' apparatus surpasses all other alphabetic apparatus; their opinion is, also, that M. Siemens' improvements in the construction of electro-magnets will prove advantageous.

Horn's Igniting Telegraph, patented June 25, 1850.—The register invented by G. H. Horn, of Boston, employs a principle, namely, the heating or igniting effect of electricity. When an electrical current flows through a fine platinum wire it ignites it, or brings it to a red heat. If this wire is bent, as at A, in figure 55, so as to be in contact, for a short distance, with a moving fillet of paper, it will burn a hole through the paper when the current passes. This can be done with great rapidity, so as to represent probably a hundred linear letters per minute.

This instrument, the greater part of which consists of the clock-work, spool, &c., required for moving the paper. Above the clock-work are two pillars, supporting an axis, upon which is the adjustable wire-holder, the lower extremity of which is seen touching the fillet of paper. By means of the connexions and insulations of the pillars, axis, and wire-holder, the platinum wire, which passes over a little slip of porcelain at the end of the wire-holder, becomes part of the circuit, with which the two screw-cups on the right of the base-board are connected. When the wire needs adjustment, the wire-holder can be turned up on its axis.

The bed supporting the fillet of paper is also adjustable, so as to regulate the contact between the wire and the paper.

Fig. 55.



This register requires a quantity current to produce the effect of ignition, and therefore needs a receiving instrument and local battery, to be operated by the telegraphic circuit.—*Book of the Telegraph, p. 37.*

This telegraph is the same in principle with that patented by Wm. S. Thomas, Feb. 13, 1850.

Before concluding these lectures I will here notice two telegraphs which I have omitted in their regular order, and first of

The Telegraph of Brett and Little of London.—The magnet employed in this telegraph is in the form of a ring or horse-shoe, and is suspended in the centre of helices of copper wire, which are double and of a circular form. This magnet is deflected either to the right hand or to the left, according to the direction of the current. The indicators are not magnets, but are moved by the agency of the magnets, by which a distinct and certain indication is insured.

Another modification of this instrument has been made by Mr. Little, which is as follows: the patent instrument is of the form of a disk of mahogany, about 1 foot high by 8 inches broad, standing in a vertical position on a pedestal; the only appliances at the back being the metallic buttons, or binding screws, necessary to convey the galvanic fluid from the battery to the indicators. Two tubes of glass about one-fourth of an inch in diameter, and 3 inches high, are placed in front of the disk, with the alphabet engraved on a metallic plate placed between them, with the number of deflexions required to express each letter, stated in plain figures. On the top of each of these tubes, which contain spirits of wine, is a small but powerful cylindrical magnet about one-fourth of an inch in diameter, from the bottom of which are suspended by magnetic attraction, two needles with the points upwards.

On completing the galvanic circuit, these needles are deflected with equal rapidity with one on an axis; and on breaking connexion, the needle

is instantly arrested in its fall to the perpendicular by the density of the fluid, with almost as dead a stop as the seconds hand of a watch, avoiding the vibration so annoying in the old system, which tends so much to puzzle and mislead.—*Lond. Mining Journ., Vol. XXI, p.* 183.

Bakewell's Electric Telegraph.—This is a modification of the instrument of Alex. Bain, Esq., noticed under the head of Electro-chemical Telegraphs, employing the same chemical agent, but instead of holes cut in paper, the message to be sent is written on a sheet of tin foil with sealing wax varnish; this is placed on the transmitting cylinder; all the lines of the non-conducting varnish serving to break the connexion. On the receiving cylinder, a sheet of paper moistened with acidulated ferro prussiate of potash is placed. When the connexion is completed, electro-chemical decomposition is effected; and where any interruption occurs, no change takes place.

For the Journal of the Franklin Institute.

On the Steamboats of the Western Waters of the United States. By J. V. Merrick.

In another part of this number will be found a table extracted from the report of proceedings in the Wheeling Bridge Case, containing (what are believed to be) reliable data respecting some of the steamboats now running on the Ohio and Mississippi rivers. An examination of some of the details of this table will show conclusively a very curious fact respecting the practice of Western engineers, which, although it may before have been noticed, has been hitherto overlooked, or ignored in the construction of their machinery.

The Western steamboats are made on a peculiar type, which is to be found principally in that section of the country, and whose existence at this stage of improvement in river navigation only serves to show how far prejudice, and a spirit of servile imitation, can prevent advances dictated by science, or by successful experience elsewhere. They are, with but trifling exceptions, propelled by a pair of high pressure inclined engines, bolted to timber frames, and with very long wooden connecting rods; each engine being attached independently to its own wheel. They are placed on deck, (which is within two or three feet of the surface of the water,) and with the boilers occupy from one-third to one-half the length of the boat, and the whole breadth inside the wheel-houses. The valves are of the description known as "poppet," which till within a very recent period were made single, and required considerable power to work them, but are "double" (or balanced) on the new engines. Steam and exhaust valves are worked by separate cams attached to their respective rock-shafts; provision is made for connecting these shafts when it is desired to work full stroke, but the cut-off is not adjustable. Each valve is lifted by a lever, in the usual "safety valve" style, which lever stands parallel to the cylinder, and covers the tappets on the rock-shafts; the latter, of course, crossing the cylinder near the middle of its length. The valves are not allowed to lift high enough to give an area of passage equal to their own, which in itself is usually smaller than given by the usual English and our own Eastern practice.

The boilers are cylindrical, with two flues; are set in brick work, and

placed upon the deck forward of the engines; furnaces forward; and the flame, &c., passing under the shells to the after end, returns through the flues. It is the universal custom to carry steam of a very high pressure in the boilers, a circumstance which has now become a sort of proverb, and the results of which, combined occasionally with those of an opposite error in respect to the water level, may be found in the records of steamboat disasters in the United States, and present a lamentable instance of reckless disregard for the safety of human life.

The object of the present article is to show that this high pressure, with all its attending evils, is entirely unnecessary; and it is to this "curious fact," before adverted to, that it is now desired to call attention.

The application of an indicator to any of these engines would demonstrate this point; but as such attachment has not been made, so far at least as I am aware, recourse must be had to another method of proof.

The economical efficiency of a boiler depends on the relative proportions of its effective heating surface, grate surface, and least cross section of flues or chimney, and the rapidity of combustion, or consumption of fuel. The greater the rapidity with which combustion is carried on, the less perfect is it, and hence the less economical will it be. Hence, (within certain limits,) that boiler which burns least fuel *per square foot of grate*, in a given time, or, in other words, which has a larger grate to burn the same fuel, evaporates the greatest amount of water by the combustion of a pound of fuel. That boiler which presents the greatest extent of effective heating surface to the action of the combustible, will, of course, draw from it the greatest useful effect with a given velocity of draft. Finally, the less the velocity of draft requisite, the greater useful effect will be obtained, since the products of combustion have more time to communicate their heat.

To compare, then, the circumstances attending the consumption of fuel with those of other instances, I shall take an average of five western packets, (in order to obtain a mean result,) and compare it with some steamer whose consumption per square foot of grate is about the same as theirs.

On referring to Bartol's *Marine Boilers*, we find that the steamer *Mayflower*, running on Lake Erie, consumes 6160 pounds of bituminous coal per hour, on a grate of 151 square feet, or 40·8 pounds per square foot per hour; total heating surface, 4791 square feet, or ·778 feet of surface per pound of coal per hour; useful effect produced, 5·94 pounds of water per pound of coal.*

In the five packets before alluded to, and which are hereafter specified by name, the average consumption of fuel is 3254 pounds of bituminous coal or its equivalent per hour, on a grate of an average area of 79·2 sq. feet, or 40·87 pounds per square foot per hour; total heating surface averages 1940 square feet, or ·596 feet of surface per pound of fuel per hour; being but ·766 that of the *Mayflower*.

The velocity of draft under these circumstances, since the same quantity of coal is burned per square foot of grate, would depend on the rela-

* The author states it at 6·3 pounds, but informs us at the end of the work, that this is based on the supposition that there is no difference between boiler and cylinder pressure; assuming this at 2 pounds, which may be called a minimum, 5·94 is the real coefficient.

tion between the respective areas of flue and grate. In the five packets it is as follows:—

	Consumption of bituminous coal per hour pr. sq. ft. grate.	Ratios of areas of grate to flues.
Clipper, No. 2,	43·00	1 to ·1250
Hibernia, No. 2,	37·37	1 to ·1336
Bostona,	39·06	1 to ·1780
Buckeye State,	49·72	1 to ·1830
Messenger, No. 2,	35·22	1 to ·1654
Mean,	40·87	1 to ·1570

Or an average ratio of 1 to ·1570, while in the *Mayflower* it is 1 to ·1780; whence it follows that to allow the same amount of air, &c., to pass, the velocity required in the western boats must be to that in the boiler of the *Mayflower* as 1·134 to 1·000, and hence that in the latter case more useful effect would probably be obtained from the fuel.

Finally, the boiler of the *Mayflower* is a single "rising flue," while those of the western boats are cylindrical, and it is known that in the latter form, the proportion of *effective* in the total heating surface is less than in the former. Since, then, all the circumstances are concurrent to more perfect combustion in the boiler of the *Mayflower*, and since in that case the useful effect is as 5·94 to 1, it appears that from $4\frac{1}{2}$ to $5\frac{1}{2}$, to 1 will be a fair allowance as a *maximum* effect in the western boats. In order to allow for the difference in temperature of the water entering the boilers, and to insure a perfectly fair comparison, I shall employ in it the higher number or 5·5 pounds of water to a pound of fuel, as the maximum useful effect.

Having determined this point, it remains to show that with this *maximum* of evaporation, it is impossible to produce a volume of steam sufficient to fill the cylinders, at their point of cutting off, and number of revolutions per minute, with steam of any thing like the pressure carried in the boilers.

Referring to the table, we obtain the following calculation, which is tabulated for comparison:

Names of Packets.	Space displ'nt of piston for each double stroke at point of cutting off.	Revolutions per minute.	Consequent volume of steam used per minute.	Consumption of fuel per minute.	Calculated vol. water evap. at the abv. stand'rd	Ratio vol. steam to vol. water.
1 Clipper, No. 2,	58·61 cu. feet.	22	1289 cu. feet.	42·42 lbs.	3·633 cu ft.	342
2 Hibernia, No. 2,	91·66 "	19	1742 "	49·81 "	1·785 "	394
3 Bostona,	77·66 "	20	1553 "	52·09 "	1·583 "	339
4 Buckeye State,	91·66 "	18	1650 "	71·35 "	6·279 "	261
5 Messenger, No. 2,	78·59 "	19	1493 "	50·53 "	5·362 "	276
		Average,	1545 "	53.24 "	4·928 "	322·4

Giving as an average result, a volume whose corresponding pressure is 74·7 pounds above the atmosphere; while that carried in the boilers was respectively 150, 150, 145, 140, and 150; average, 147 pounds; difference between boiler pressure and maximum average cylinder pressure, 72·3 pounds.

I am not to be understood as saying that the pressure never exceeds this point; far from it; it is very possible that at the commencement of a stroke, or at some point in it, it may be higher: but simply, that the *average* pressure during the time for the admission of steam, cannot differ greatly from the one named.

It may be very true, that the consumption of fuel is, of all other data respecting the performance of an engine and boilers, the least reliable; since different firing, different qualities of coal, and differently arranged boiler surface, &c., may modify the useful effect within wide limits: but when it is considered that on the one hand, the Mayflower is a boat (running on Lake Erie) burning the same quality of fuel as the Western boats; that her consumption is the average of her running trips; that it was certainly not to the interest of the reporter to magnify that consumption, when it was known that the report was intended for publication; and, on the other hand, that an average of *five* packets, running on different routes, and supposed to have all the modern improvements, &c., was taken with an average of their running consumption through the whole trip; that it was certainly not to the interest of those reporting their performance, to name a *less* amount of fuel than the true consumption, (since, other things being the same, a diminished consumption would require a diminished height of chimney,) it is certainly, in view of these points, not possible to conceive that the maximum pressure in the cylinders as calculated can vary greatly from that actually maintained.

It will be observed that the least volume in the table just given (that of No. 4) gives a pressure of 96·6 pounds above the atmosphere; while the greatest volume (that of No. 2) gives a pressure of 58 pounds; mean, 77·3

Why then, it will be asked, is this tremendous pressure carried, if so useless in propulsion? Among other reasons may be named; 1st, Custom and prejudice, which on the Western waters require a high pressure of steam to be maintained; otherwise the boat is not considered either fast or powerful. 2d, The absurd notion existing among a large class of their engineers, that steam has a momentum or impact, which at high pressures imparts a force to the piston over and above that due to its pressure, when considered as a compressed and elastic vapor. 3d, and most probably the principal reason; a contraction in the steam openings and pipes, which increases the friction due to the passage of steam at such high pressure, and diminishes the velocity at which it can be supplied to the cylinders, thus rendering necessary a great difference between the boiler and cylinder pressure.

If these reasons are just, the remedies are quite as plain, and need not be enlarged upon. It is easy to increase the area of passages, and insure a liberal supply of steam to the cylinders, even though such augmentation be attended with increased expense; and expense should be no object when viewed as a certain means of obviating the *necessity* for carrying this dangerous pressure of steam. Then legislative enactment must lend its aid to compel engineers to work their boilers at the minimum pressure, which, with wide throttles, will be found as efficient as the present system.

There is, therefore, no doubt that a much lower pressure of steam might with the same engines perform all that is done by the exalted pressure, now carried so universally; while at the same time the comfort,

economy, and, above all, the safety of the boats, would be vastly increased.

But there is another means of overcoming the difficulty, and of increasing the economy of these packets, viz: the employment of condensing engines, which would at once cut down the requisite initial pressure 12 to 14 pounds per square inch, and by lessening the work of the boilers, permit a more perfect combustion of fuel. And although prejudice has done its utmost to prevent, or rather to postpone, in that section of the country, this improvement, high pressure engines will as certainly be driven from the Western rivers, at some future day, as they have been from the Lakes within the past few years. Their use on Lake Erie, which was formerly the *rule*, forms now a bare exception.

For the Journal of the Franklin Institute.

On Marine Propulsion. Reply to J. V. MERRICK, Esq. *By* J. W. NYSTROM.

Mr. Merrick's "*clear case*" resembles so much the turbid water of a swollen stream, that we think it must pass through the filterer of criticism, taking for our compound the *Static* and *Dynamic momentum.*

The first point to be tested will be found on page 271. In the first paragraph, Mr. M. states that if the above is not "clear enough he will state it in another form." *No, it is not clear.*

Let the arrows m, n, o, figs. 1 and 2, plate V, represent the direction of motion of the centre of the paddle wheels on a steam vessel, w, w, w, being the load line and water in which the paddles act.

The accompanying diagram plate V, represents two different situations of the vessel. Fig. 1, the paddles take hold of a rock in the water, so that the vessel can move freely without touching the rock; then there will be no slip of the paddles, while the vessel moves the space H. Fig. 2. The paddle acts freely in the water, so that while the vessel moves the space H, the paddle moves backwards the space V, which then will be the slip. Suppose the vessel moves the same space H in a unit of time; then if slip causes a loss of effect, more power should be required in fig. 2 than in fig. 1.

First Case, Fig. 1.—The crank of the steam engine is supposed to be in the same line as the acting paddle; then the line $R + r$ will be a lever of the second kind, with its fulcrum against the rock at c. The letters will denote:—

r = radius of the crank.
h = pressure in the crank pin.
b = velocity of the crank pin.
R = radius of the paddle wheel.
B = resistance in the centre line of the paddles.
H = velocity of the vessel.
c = resistance against the rock.

$$\text{Static momentum,} \quad . \quad \begin{cases} \text{Action } (h + c = B \text{ reaction.} \\ B : h = (R + r) : R. \end{cases}$$

$$\text{Dynamic momentum,} \quad . \quad \begin{cases} b : H = (R + r) : R. \\ B : h = b : h. \\ \text{Action } h\,b = B\,H \text{ reaction.} \end{cases}$$

Second Case, Fig. 2.—The crank pin moves the space W while the paddle moves the space V. There will be found a point, c, on the paddle arm which has no motion, and is therefore a fulcrum thereof.

I = pressure in the crank pin.
W = velocity of the crank pin.
B = resistance in the paddle journal.
H = velocity of the vessel or journal.
M = resistance of the water.
V = velocity of M.
c = resistance in the fulcrum c; and

$$I + c = B \quad \text{of which} \quad B = I + c. \qquad (1.)$$

$$I : c = S : r \quad \text{"} \quad S = \frac{I\,r}{c}. \qquad (2.)$$

$$V : W = s : (S + r) \quad \text{"} \quad s = \frac{V\,(S + r)}{W}. \qquad (3.)$$

$$s\,M + B\,S = I\,(S + r) \quad \text{"} \quad s\,M = I\,(S + r) - B\,S. \qquad (4.)$$

By the insertion of the formula (3) in (4), we obtain—

$$M\,\frac{V\,(S + r)}{W} = I\,(S + r) - B\,S.$$

$$M\,V = \frac{I\,(S + r) - B\,S}{\frac{(S + r)}{W}} = \frac{I\,W\,(S + r) - W\,B\,S}{S + r} = I\,W - \frac{W\,B\,S}{S + r}. \qquad (5.)$$

By the insertion of the formulæ (1) and (2) in (5), we obtain—

$$M\,V = I\,W - \frac{W\,I\,r\,(I + c)}{\left(\frac{I\,r}{c} + r\right)c} = I\,W - \frac{W\,I\,r\,(I + c)}{I\,r + c\,r} = I\,W - I\,W\,\frac{r\,(I + c)}{r\,(I + c)}$$

that is to say, $M\,V = I\,W - I\,W = 0$. Or, M V is no part of I W.

We see now that M V is of no effect at all for propelling the vessel; it only serves to keep the paddle arm stationary at the fulcrum c, and if we examine M V without any theory, we will find that the resistance M acts *with* the vessel, but the velocity V acts *opposite* the same, and they thereby counterbalance each other, and produce *no* effect for propelling the vessel.

Let the velocity of the paddle at the circumference be J, and V a fraction thereof. The effect exerted in the water should be M J V; but if we carry M J V to the fulcrum it will be equal to 0, because V = 0, and there it will act as a resistance in marine propulsion, as the rock in fig. 1, with no effect. Then we have another lever of the second kind, with its fulcrum in c, which we will compare with the first case, fig. 1.

Fig. 2:—

Static momentum, . . $\left\{ \begin{array}{l} \text{Action } I + c = B \text{ reaction.} \\ B : I = (S + r) : S. \end{array} \right.$

Dynamic momentum, $\left\{ \begin{array}{l} W : H = (S + r) : S. \\ B : I = W : H. \\ \text{Action } I\,W = B\,H \text{ reaction.} \end{array} \right.$

But $B\,H = h\,b.$

Therefore $I\,W = h\,b = B\,H$ which was to be proved.

We see now that the effect given in both fig. 1 and fig. 2 is equal,

and what the velocity in the one case is greater than in the other, the pressure will be so much less, because it acts on a shorter lever. To compare this with screw propellers, let the letters represent—

R=P pitch of the propeller.

S=(P—s) as in the paddle wheel.

Then we have $W : b = S : P$.

With equal velocity of the vessel, the different values of the pressure W is measured by S=(1—s,) and caused by different areas of propellers. (See further respecting acting area of propellers.)

The appearance of loss of effect by slip is measured by the mass of water forced backwards;—it can be viewed in another way. Suppose a vessel runs in a canal say 1000 feet long, and has a sectional area equal to 10 of the propeller, whose pitch is 10 feet; then, when the propeller has made 100 revolutions, the vessel should run the 1000 feet if there was no slip. But suppose the slip to be 50 per cent.; then when the vessel reaches the other end of the canal, the propeller will have made 200 revolutions: that is, 100 revolutions which have propelled the water backwards; consequently, at the other end of the canal there should be no water left for the vessel to float in. But it will be found that when the vessel has passed the 1000 feet, the water is at the same height as when the vessel started from the first end. So it will be with a vessel starting from Liverpool for New York,—on reaching New York, the water will not be higher in Liverpool or lower in New York, extracting the tide. At the moment that a vessel starts, the slip is equal to the unit; if it is a measure of loss of effect, the vessel could never be started.

Mr. M. says, "And then the ratio of the coefficient * * * to the velocity of the water backward." Now, after Mr. M.'s lengthy disquisition, "that slip is no loss of effect," he comes to the conclusion of my first formula: $p\,v = r\,s$, or, as Mr. M. expresses it, $p : r = s : v$, in which

p = coefficient of the vessel.

r = area of floats multiplied by the coefficient for resistance to plane surfaces.

v = velocity of the vessel.

s = velocity of the water backwards (slip).

This is a proof that slip is *no* loss of effect. The effect delivered from the steam engine $r\,s = p\,v$ the useful effect.

After Mr. M. has embodied the formula, he condemns it as wrong, and says it should be $p = r$.

If Mr. M. had substituted *resistance* of the vessel instead of *coefficient*, it would have been all right. But this "coefficient" makes the remainder of his article wrong.

In his note Mr. M. says, "By the coefficient of a vessel, I mean that, * * * or 1 nearly." Here Mr. M. is confused in the difference between effect and pressure. When a body, P, is to be moved from its passive state, and has no other resistance than its own inertia, the *pressure*, B, which is required to give that body a certain velocity, V, in a given time, T, is

$$B = \frac{PV}{gT}. \qquad . \quad . \quad . \quad . \quad . \quad . \quad (1.)$$

But the *power* which is required to give the same body the same velocity in the same time, is

$$B\,H = \frac{P\,V^2}{g\,T}. \quad . \quad . \quad . \quad . \quad . \quad . \quad (2.)$$

D = total distance which the body has moved in the time T, and

$$\text{Pressure } B = \frac{2\,P\,D}{g\,T^2}. \quad . \quad . \quad . \quad . \quad . \quad (3.)$$

$$\text{Effect } B\,H = \frac{2\,P\,D}{T}. \quad . \quad . \quad . \quad . \quad . \quad (4.)$$

To apply this to vessels, we must first suppose the vessel P to have no other resistance against B H but its own inertia; then B H would give the vessel P the velocity V in the time T, and if at the end of the time T the pressure B be taken away, the vessel would still continue with the velocity V until some resistance acts opposite her direction; but as a vessel has the additional resistance of the *water* to sustain, the effect B H will not be sufficient to give the vessel the velocity V in the time T; we therefore will find another value of B H. The letters will denote—

R = resistance of the water at the velocity V.

r = mean resistance of the water in the time T.

The effect which is required to the resistance of the water in the time T will be—

$$\text{Effect} = \frac{r\,D}{T} \quad . \quad . \quad . \quad . \quad . \quad . \quad (5.)$$

This must be added to the formula (4), so that

$$B\,H = \frac{2\,P\,D}{T} + \frac{r\,D}{T} = \frac{D\,(2\,P + r)}{T}. \quad . \quad . \quad (6.)$$

We see here that even in the time T the effect B H is, independent of $g = 32{\cdot}08$.

The time will be $T = \dfrac{D\,(2\,P + r)}{B\,H}$.

At the end of this time T, the vessel has obtained the velocity = V, the resistance of the water = R, and the equation (4) will be = 0. Then the effect which is required to keep the vessel at the velocity V will consequently be B H = R V.

We see now that the effect which propels a vessel, a uniform velocity is entirely independent of the moving mass P, and the acceleratrix g, and that the resistance R, depends on the greatest section area of the displacement, friction area, and form of the hull. The square of the velocity multiplied "by the cubic feet of water" in motion, is a measure of the effect which has given the mass of water that motion, and *not* a measure of number of pounds.

Mr. M. says: "But the projecting area acting * * * multiplied by the secant, * * * is the advance of the vessel during a revolution."

It is well known that resistance to planes in motion in fluid, can be less by moving the plane at some angle, more or less than 90° to the direction line; but I did not know that it could be greater than itself, as will be the case when multiplied by a secant, which is always greater than one. The area Mr. M. multiplies, can be increased and diminished *ad libitum*, in the same diameter of propeller. But when Mr. M. finds his secant, he adds two squares together and divides the sum by a square;

he calls that a secant$=1\cdot40$; that must be a secant$=1\cdot40$ *square radius;* then I suppose the corresponding angle will be *square degrees!* But if Mr. M. extracts the square root of his equation, he will obtain a true secant for the angle described, but then it will be my formula *turned upside down*, which makes it all wrong. It is the formula Mr. M. has condemned, and entitled "empirical."

The area Mr. M. calls 108 square feet, is only 65, and multiplied by the secant, it will be about 91 square feet.

Further, Mr. M. says, "the pressure constantly exerted by * * * is entirely independent of the velocity by which the vessel moves,"= a given pressure in the steam cylinder can produce different velocities of the vessel! On which side of the equation does Mr. M. carry the circumstances? Next, as regards the acting area of the propeller, he says, "It appears to me, however, to be neither of these; but the projected area by the ratio of length between the helicoidal path traversed by the centre of effort, &c.;" if we apply this to our proposed test, it will come out, the more pitch in proportion to the diameter, the greater the acting area of the propeller should be.

This is entirely opposite to the fact. It is a fact that, propellers with more pitch and slip, employ the effect better for propelling, (if they do not exceed $n=\frac{200}{\mathrm{P\,S}}\sqrt{\mathrm{D}}$ revolutions per minute,) but there is another reason, namely: *that a less acting area has a greater velocity, and that the resistance to the same is in proportion as the square of its velocity, and that the friction in the water is in proportion as the acting area.*

I will here add a formula on which this acting area should depend.

Letters denote—

A = acting area of the propeller.		(less than $0\cdot785\,\mathrm{D}^2$.)
D = diameter " "		(extreme.)
P = pitch " "		
C = circumference "		(at the diam. D.)

$$\mathrm{A}=\frac{2\cdot5\,\mathrm{D}^3}{\sqrt{\mathrm{P}^2+\mathrm{C}^2}}$$

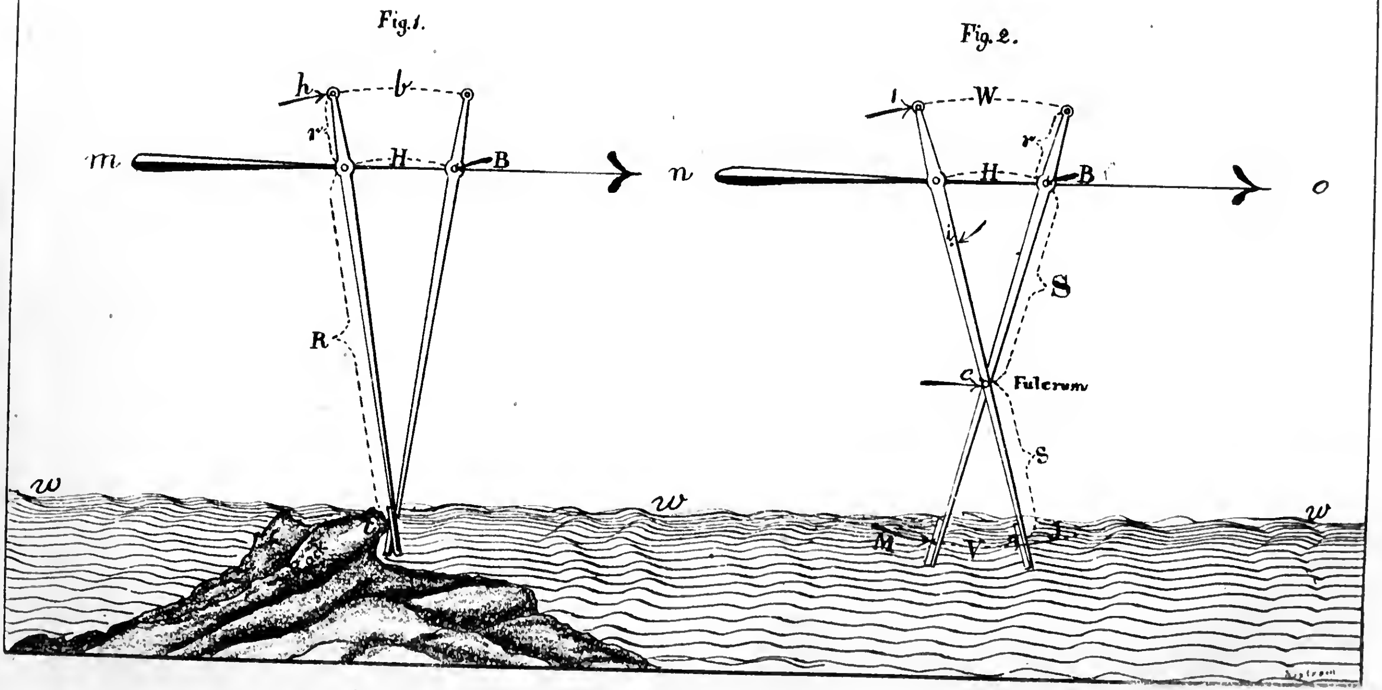
This formula forms a part of the one given for finding the slip. The divisor $\sqrt{\mathrm{P}^2+\mathrm{C}^2}$ is a secant for an angle whose tang. $=\mathrm{P}$ and radii $=C$. When I can, I rather avoid trigonometrical expressions, but *simply* this will be, *multiply* the area of the propeller by the *sine* for the angle of the propeller blades to the axis at the periphery; the product should be the acting area.

Mr. M.'s theory is, *divide* the projecting area of the propeller blades by the *sine* for the same angle, when the pitch is the advance of the vessel during one revolution, the quotient should be the acting area of the propeller; expressed in a formula without trigonometry, it will be—

$$\mathrm{A}=\frac{\mathrm{D\,L}m\sqrt{\mathrm{P}^2\,(1-s)^2+\mathrm{C}^2}}{4\,\mathrm{P}.}$$

C = a circumference taken at the centre of effort of the blades.
L = length of the propeller.
m = number of blades.
s = slip in a decimal fraction.

MARINE PROPULSION.



These four quantities have certainly something to do with the acting area, but they are not at all a measure of the same; they can vary considerably with the same acting area. But, the projecting area of the cylinder described by the propeller, multiplied or divided by some coefficient can not vary at such ad libitum. It appears to me, Mr. M. has mistaken the propeller for a paddle wheel, where his rules would be more likely to be applicable.

Mr. M.'s remarks about "action and reaction," I will not contradict, as I may be somewhat mistaken in the expression; but I will here explain how I understand it: action and reaction = pressure and resistance *in statics.* But in *dynamics* action and reaction = power.

When Mr. M. finishes his theory, he says: "such are the indications of theory, but it is found that the values given by them are but approximate." How is it possible that a theory composed of such incongruities ever can reach approximation? It is often the case that such a theory is applied in practice, and gives a wrong result, *then theory in general* is blamed. However, Mr. M.'s theory will surely do no harm in practice, because it is applicable *first*, when the work is finished. "And that there are some modifying circumstances experienced in practice." We cannot expect a result to come out nearer than the circumstances are carried, and Mr. M. says himself that "circumstances are generally on one side of the question."

After Mr. M. has repeated my statements based on Mr. Isherwood's error, he says: "The whole structure of the argument is built upon sand." *Yes, sir*, but I am not the builder; Mr. Isherwood first designed it, and applied it to the *San Jacinto*, and I made remarks upon it, stating it to be wrong, &c., &c.

But after all, I cannot find where Mr. M. proved my misapprehension in the first principles of dynamics; he says that the first equation "should have been $p = r$; consequently the results attained by it are valueless:" that is no proof at all, to say this is wrong; "consequently," *not right.*

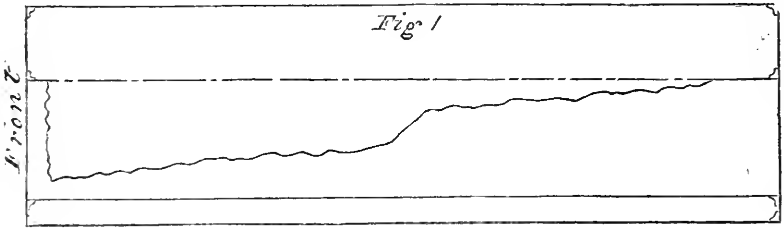
For the Journal of the Franklin Institute.

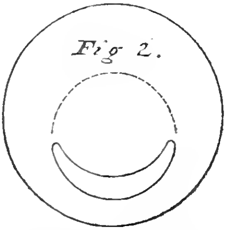
Steam Boiler Explosion in New York.

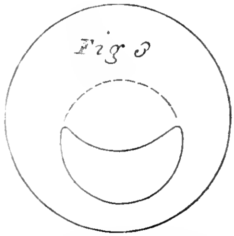
One of the boilers of the extensive sugar refinery of Messrs. Howell, King & Co., Duane street, New York, exploded early in the morning of the 12th of April, at the moment of starting the engine. There are four boilers in the set, each 6 feet in diameter, 40 feet long, with one flue 42 inches diameter; thickness of iron used in the shell, $\frac{5}{16}$-inch, and in flue, $\frac{3}{8}$-inch. The furnace is within the flue, at the front end. This form of boiler is the kind generally used with Cornish engines, and is capable of resisting a heavy pressure of steam.

In the present case, it will observed by fig. 1, which gives a longitudinal section of the boiler, that the top of the flue, at the front end, has been torn from the head of the boiler, and crushed nearly to the bottom. At the back head no fracture is visible, but there is evidence of severe strain. Fig. 2 is a cross section of the boilers at the front; and fig. 3 a

section at the centre; both showing the shape of the flue after the accident. The dotted lines in all three figures show the original form of the flue.







As is usual in such cases, the evidence before the Coroner's Jury (five men were severely injured, three of whom soon after died,) was very conflicting, so far as opinions went; but the following facts were elicited:

The engineer did not know the state of water, and could not tell any thing about it. The boilers were independent of each other, each having a safety valve, and also a screw valve, for shutting off or connecting with the other boilers. It is also stated, that baked molasses and bone-black were found around the safety valve after the explosion; and that the screw valve, which admitted the steam from this boiler into the common steam pipe, was found shut.

If we suppose the boiler to have had its full supply of water, and that the explosion was the result of an excess of steam, caused by the safety and screw valves being shut, we have three things to account for.

1st, Why did this one boiler generate such an excess of steam, while the other three in the same time had reached a pressure of but 35 pounds?

2d, The explosion took place at the starting of the engine, which, in the absence of positive testimony to the contrary, is considered good evidence of a short supply of water. 3d, The greatest depression in the flue, and the only fracture, is over the furnace, where there would be the least strength in case of low water.

If, on the other hand, we suppose the water to have been low in this boiler, as was thought by some of the witnesses, who judged from the appearance of the iron after the accident, then it would have generated a higher pressure of steam in the same time than the other boilers; and if we still further suppose that the screw valve of this boiler was not fully shut, (no reason was given for this valve being closed,) but that it would allow the passage of a small quantity of steam, then the starting of the engine would cause the water to rise over the heated surface of the flue, and the explosion follow in the usual way. The explosion may be explained by either mode, and as positive evidence is very limited, we may be at liberty to take either side of the question. H.

*Cornish Engines.**

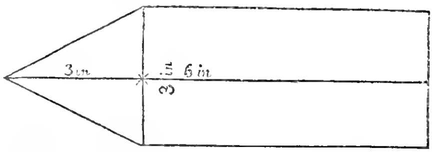
The number of pumping engines reported for Dec., 1851, is 20. They have consumed 1542 tons of coal; and lifted 13,000,000 tons of water 10 fathoms high. The average duty of the whole is, therefore, 50,000,000 lbs. lifted one foot high by the consumption of a bushel of coal weighing 94 lbs.—*Lean's Engine Reporter, Jan.* 5, 1852.

Hints on the Principles which should regulate the Forms of Boats and Ships, derived from original Experiments. By Mr. William Bland, *of Sittingbourne, Kent.*†

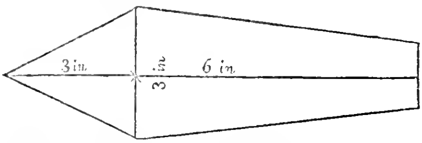
Continued from page 191.

Chapter VI.—Experiments relating to the Stern.

Experiment 17.—First, with the sides parallel and tapered. Two models having the same form of bow, an isosceles triangle of 3 inches perpendicular distance from the base, and 3 inches wide; with the bodies attached 6 inches long; one of them with parallel sides, the other tapered as shown in the diagram; scale, $\frac{1}{4}$-inch to one inch.



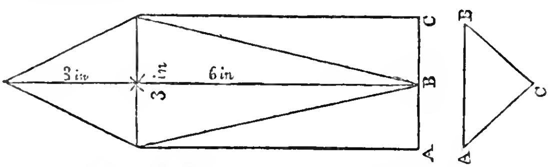
No. 1.—Weight 10 oz.; thickness $1\frac{1}{2}$ inch.



No. 2.—Weight 10 oz.; thickness $1\frac{1}{2}$ inch.

Upon being tested against each other, there appeared a slight degree of speed in favor of the parallel-sided model (No. 1), and decidedly greater stability than was possessed by the tapering-sided model (No. 2).

Experiment 18.—A third model (No. 3) of the same bows, length, width, and weight, was tested against No. 1; but having its sides beveled towards and at the stern.



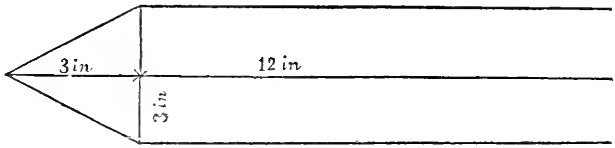
No. 3.—Weight 10 oz.; thickness $1\frac{1}{2}$ inch.

The result of the trial was, that the speeds of No. 1 and No. 3 were equal; but No. 3 was inferior in stability, and sank deeper into the water than No. 1, and was less steady in its course.

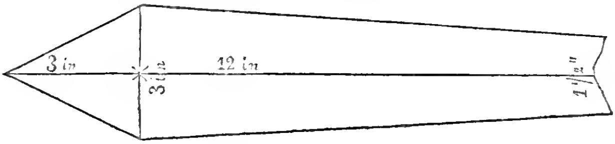
* From Herapath's Journal, January 17, 1852.

† From the London Architect for September, 1851.

Experiment 19.—Two models having the same form of bows as the preceding Nos. (1 and 2,) but with the bodies 12 inches long; one of them with the sides parallel, the other tapered, as exhibited in the diagrams marked Nos. 4 and 5.



No. 4.—Weight 17 oz.; thickness $1\frac{1}{2}$ inch.



No. 5.—Weight 17 oz.; thickness $1\frac{1}{2}$ inch.

When the models (Nos. 4 and 5) were tested together, the speed of No. 5, having tapered sides, was considerably inferior to the one with parallel sides; the proportion in speed of the parallel sides, to that of the tapered sides : : 3 : 2; and as respects stability, the parallel-sided model had very greatly the advantage.

Experiment 20.—Again, experiment made between two models of the same form of bows, &c., as those just tested, but with the bodies of each lengthened to 18 inches; one having the sides parallel, the other tapered; indeed, both after the forms of Nos. 4 and 5, but longer by 6 inches. The weight of each equalled 1 lb. 7 oz.; thickness $1\frac{1}{2}$ inch.

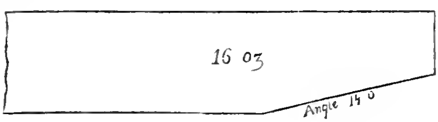
The speed, in this instance, between these models was not so dissimilar as in the trial with the two former models (Nos. 4 and 5); but still the tapering proved injurious, and in the proportion of 5 : 4.

In the experiments here given, they prove most decidedly that tapering the whole length of the body of a ship is very detrimental to speed.

The experiments next undertaken relate to the tapering of the under part or bottoms of ships towards and at the stern.

Experiment 21.—Two models of the same form of bows, and having their respective lengths, breadths, thickness, and weight equal; but one of them cut inclined up an angle of 14°, commencing at one-third of the length from the stern; the other also cut inclined up, but at an angle of 7°, and commencing at the mid-length, as in the diagrams A and B, which when tested together, A beat B in speed a trifle.

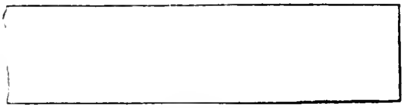
A



B

Experiment 22.—Again, a third model marked C, of the same dimensions and weight as A, but the bottom not cut inclined up; upon being tested with A, A had the greater speed of the two.

C



Weight 16 oz.

The model C was then tested with a model E, which differed from C by having its sides towards and at the stern inclined by a gentle curvature, commencing from near the midship. The balance rod gave the speed greatly in favor of the curve sides; for the model E required the additional weight of 2 oz. to be put into it to reduce its speed to an equality with the model C. The weight of each model equalled 16 oz.; therefore the speed of E was superior to the speed of C by one-eighth the weight.

Experiment 23.—Two models having the same form of bows, likewise the same breadth, length, depth, and weight; but one of them with parallel sides and bottom as the model C; the other, with the sides tapered curvilinearly towards and at the stern, and the bottom cut up inclined, and commencing in both instances at one-third or 6 inches from the stern; the length of each model 18 inches, and their respective weights 17 oz.

The difference of speed between these two models was great, and on the side of the curvilinear-formed stern, and nearly in the proportion of 3 : 2.

Experiment 24.—When the parallel-sided model (the one employed in the last experiment) had its sides made also curvilinear, but not the bottom, its speed, upon again testing the two last models together, was found to be improved very materially.

These latter experiments were tried against each other by weights, as well as by the difference of the length of lever, and the results were, that the model with curvilinear sides and inclined up bottom, beat in its speed the model with parallel sides and bottom, as to require the additional weight of 8 oz. to be put into the former to reduce its speed to an equality with the latter.

Experiment 25.—Upon shaping the parallel sides only to the curvilinear form of the swifter model, the speed of it was so far increased, in consequence, that 3 oz. extra weight was then sufficient to equalize the speed of both.

Experiment 26.—The curvilinear sides of the original parallel-sided model were next reduced to straight lines, the convexity of each being removed; and when tested with the swift model, it was found to be considerably injured in its speed, having lost by the alteration of the curves to straight lines, to the amount of $1\frac{1}{2}$ oz. in weight; because the now straight line tapered stern, required the additional weight of $4\frac{1}{2}$ oz. to be put into the swifter model, to equalize their speed, instead of 3 oz., when the sides were curvilinear.

The curve employed in the foregoing experiments was the segment of a circle, which subtended at the centre of the length of the straight line in the proportion of $\frac{1}{4}$-inch in 6 inches. The angle of the tapering, measured by straight lines, was 10°.

Experiment 27.—Having altered the curvature of the sides in another model, and from the subtension of $\frac{1}{4}$-inch to $\frac{1}{2}$-inch in 6 inches of the length, the speed upon trial was proved to be deteriorated to the amount, in weight, of 1 oz. out of 2 oz., the previous speed, or injured by one-half. Indeed, after many experiments made with the view of thoroughly testing the principle of tapering of the sides and bottoms of models towards and at the stern, the results gave equal benefit; meaning, that when the sides were tapered, the improvement in the speed which followed was, when estimated by weight, equal to 4 oz. And the tapering of the bottom towards and at the stern, produced improvement in the speed likewise equal to 4 oz.; or 8 oz. altogether, in superiority of the model having its sides and bottom continued parallel and level.

(To be Continued.)

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, April 15, 1852.

Samuel V. Merrick, President, in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Letters were read from The Royal Society of London; The Royal Geographical Society of London, and The American Institute of New York.

Donations were received from the Royal Geographical Society, London; The Statistical Society, London; The Royal Cornwall Polytechnic Society, Falmouth; The American Institute, City of New York; Hon. John Robbins, jr., Member Congress; Wm. Jackson, Esq.; The Maryland Institute, Baltimore, Maryland; Messrs. D. Appleton & Co, City of New York; John J. Hill, Esq., Albany, New York, and from Messrs. Henry Nolens, Dr. B. H. Rand, Dr. C. M. Wetherill, Geo. Harding, Frederick Graff, Dr. Isaac Parish, Blanchard & Lea, Prof. John F. Frazer, A. N. Macpherson, William Dougherty, and John Livezey, Philadelphia.

A work, entitled "Iconographic Encyclopedia of Science, Literature, and Art," was presented by several members of the Institute.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of March.

The Board of Managers and Standing Committees reported their minutes.

The Special Committees reported progress.

Resignations of membership (3) of the Institute were read and accepted.

New candidates for membership in the Institute (6) were proposed, and the candidates (3) proposed at the last meeting were duly elected.

Dr. Rand, Chairman of the Committee on Meetings, exhibited several photographs on glass taken by the collodion process published in the Glasgow Practical Mechanics' Journal, December, 1851, (Journal Franklin Institute, vol. XXIII, 3d Series, p. 120.) These were taken by Dr. C. M. Cresson, and fully attest the value of this process. Dr. Rand remarked,

that from the improvements suggested by the daily experience of the gentlemen engaged in these experiments, he had no doubt that he should be able to submit at a future meeting, specimens of this art, which would present a decided advance over these brought forward this evening. He further called the attention of the members to a beautiful colored talbotype from the gallery of Messrs. M'Clees & Germon.

Dr. Rand brought before the meeting the subject of the flavoring of acidulous fruit drops. In these drops the characteristic flavor of the fruit represented, is so perfectly manifested as to have attracted general remark, being far more natural than in any preparation of the fruits heretofore made. He explained that these flavors were due to the presence of certain ethereal compounds, whose discovery and application to this purpose were of recent date; that it was most probable that the flavors of the fruits themselves depended on the presence of a very small quantity of these compounds produced by decomposition as the fruit approached and passed maturity.

In reply to an inquiry, Dr. Rand remarked that he believed that no possible injurious consequences could result to the health from swallowing the minute quantities of these ethers necessary to produce the desired flavor. The flavor of bitter almonds as used daily, is due to hydrocyanic acid, one of the most rapid poisons known when concentrated, but harmless as a flavoring substance. Of the injurious effects of acids upon the teeth and stomach, there could be no doubt, and this was the only objection he could perceive against this pleasant article of confectionery.

Dr. C. M. Wetherill exhibited specimens of various ethers, some of which were made for commercial purposes, by John Price Wetherill, Esq., the rest prepared by himself. These ethers were similar to those exhibited as flavoring extracts at the World's Fair, and which were examined by Dr. Hoffman.

The pear oil was acetate of oxide of amyle; apple oil, valerianate of oxide of amyle, and pineapple oil, butyrate of oxide of ethyle. These ethers require to be diluted with 5 to 7 volumes of alcohol to develope the peculiar flavor of the fruit. Dr. W. explained in full the theory of the alcoholic, amylic, viscous, lactic acid, and butyric acid fermentations; and illustrated the theory of organic radials by reference to the series of ethyle, amyle, and methyle.

Mr. J. Z. A. Wagner presented a new form of brick of his invention, having a mortise in its centre. The advantages claimed for this brick are, economy in fuel in its manufacture, less liability to absorb moisture, the ease with which it may be divided, and greater strength of wall constructed of bricks of this form.

Mr. Wagner also exhibited a model of an apparatus intended as a steam auxiliary to sailing vessels.

Mr. George Harding placed on the table a beautiful working model of the Morse line of magnetic telegraph between New York and Washington, made by Mr. Mason of this city.

Mr. G. W. Smith brought forward specimens of fabrics from the flax cotton of M. Claussen; some of these were composed of the prepared flax alone, others with a mixture of wool. Also some specimens of the material variously colored.

Dr. Rand called the attention of the members to a drawing of Calvary Presbyterian Church, now being erected in Locust St. above Schuylkill Eighth Street.

BIBLIOGRAPHICAL NOTICE.

Elements of Chemistry. By THOMAS GRAHAM, F. R. S., &c., &c. *Second American, from an entirely revised and greatly enlarged English Edition, with numerous Illustrations. Edited by* ROBERT BRIDGES, M. D. *Philadelphia: Blanchard & Lee.* 1852.

The work of which we are here presented with a new edition, is one which at its first appearance took a very high rank among treatises on Chemistry, which it has preserved to the present time. With newer philosophical views than those which prevailed in its rival by the late Dr. Turner, it furnished very full information on the phenomena, and no where entirely lost sight of the fact that it was treating of a single branch of a much more extensive science, and that in consequence, truth could only be reached by making the connexions of the separate parts. Prof. Graham was, moreover, himself a very successful original investigator in the domains of this science, and we owe to his ingenuity and industry much valuable knowledge, which gave his work the freshness which had been almost lost in English works upon this science. In no science, however, is there more constant need of revision and renewal than in Chemistry; the great number of writers which are attracted by its modes of investigation, and the interest of its results, the innumerable applications in the various branches of art, and its intimate connexion with general physics, insures for it a host of devotees, who are peculiarly characterized by industry and patience. Hence, in a treatise on Chemistry, novelty is an unusually important attribute; and hence, too, the great responsibility resting upon an editor, to see that the work under his auspices contains all the most valuable contributions made to the science since its last appearance. A very hasty glance at the volume before us will satisfy any student that these requisites have not been overlooked by either the author himself or his American editor; and yet there is undoubtedly room for improvement by the introduction of new processes of manufacturing chemical products, and new views of their nature, which we still look for in vain in this volume. It is strange, too, to see, after the expenditure of so much care, how stereotyped errors escape all notice. These errors are, however, comparatively very few, and easily detected, and can scarcely be said to deteriorate from the very high value which is properly put upon the book by the English student of Chemistry.

Errata in the April Number.

Page 273, line 17, for "$\frac{(\text{circ.})^2+(\text{advance})^2}{(\text{circ.})^2}=1{\cdot}40$," read "$\sqrt{\frac{(\text{circ.})^2+(\text{advance})^2}{(\text{circ.})^2}}=1{\cdot}40$."

Page 277, line 12, for "length of stroke 2 feet 8 inches," read "2 feet 4 inches."

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

JUNE, 1852.

CIVIL ENGINEERING.

Strength of Cisterns and Tie-Rods. Webb *v.* Towns.—*Arbitration.**

The facts of this case are shortly these:—The plaintiff, Mr. Webb, is an extensive malt distiller, carrying on business at West Ham, Essex, and employed the defendant, Mr. Towns, a back-maker, to construct for him a number of wash-backs or cisterns of very large dimensions, constructed to contain the wort or wash, similar to the fermenting tuns at breweries. The plaintiff undertook to provide the iron tie-rods ready for fixing; the defendant was to fix the rods so provided, and provide and fix the timber work. One of these wash-backs (No. 8) suddenly burst in March, 1851, on which occasion the wash, valued at about 300*l.* was lost, and damage to the amount of 341*l.* 15*s.* 8*d.*, was alleged to be done to the premises and plant by the accident. The inside dimensions of the back were:—length, 30 feet; breadth, 20 feet; depth, 13 feet; contents, 40,000 gallons =1328 barrels=216 tons weight of fluid; and constructed of Dantzic fir, 3-inch sides, 2-inch bottom, spiked to sides, braced horizontally with three tiers of $1\frac{1}{4}$-inch tie-rods, longitudinal and transverse, *hooked* together in the middle, with fir cleets and tie-planks; in addition to which were iron bolts passing vertically through the entire thickness of the sides, besides dog-bolts at angles.

The plaintiff's witnesses, consisting of Messrs. Curtis, the builders, and men in their employ, gave evidence that the ties were improperly placed in the back, as regards heights or distances from the bottom; that the

* From the London Builder, No. 476.

rods, $1\frac{1}{4}$ common English iron, *hooked together in the manner as ordered by plaintiff, were tested by hydraulic pressure to the extent of* 25 *tons, without breaking*. Mr. Deely, engineer, gave evidence that the tie-rods were improperly placed, and on some other points of construction. Mr. John Braithwaite, civil engineer, gave evidence to the like effect, that the iron tie-rods were sufficient for the purpose; calculated the pressure that possibly could be on the bolts or tie-rods, and found it less than one-half what the bolts ought to stand; was convinced the cause was not the bursting of the bolts, but that this was the consequence; found the back slightly put together; the tie-rods were too far from the bottom, throwing too much pressure on the wood-work of the bottom, the dog-bolts too slight. He concluded that the back gave way in the first instance at the bottom, giving motion to the fluid within, and, according to the degree in which it gave way, *would increase the pressure probably from* 10 *tons up to* 40 *or* 50 *tons, depending on the velocity of the fluid*, and in his opinion was the cause of the accident. The weight on the tie-bolts could not have broken them, even to 20 tons; the breaking strength of the iron was nearer 30 than 20 tons; *did not object to the tie-bolts being hooked.*

Calculated pressure on side upper tier of bolts—

	4 at	$3\frac{1}{4}$ tons each, . .	13 tons.
Middle	4	$6\frac{1}{2}$	26
Lower	4	$9\frac{3}{4}$	39
		Total tons, . .	78

For the defendant.—His workmen and fellow-tradesmen gave evidence that the materials and workmanship were good, and the backs were constructed in the ordinary and common way—excepting as regarded the method of connecting the tie-rods together in the middle, which, by the special direction and interference of plaintiff, were hooked together, instead of being connected by eye-bolts—and they likewise spoke to the bad quality of the iron, (common English,) which, in turning to form the hook, broke several times.

Mr. Charles Humphreys, surveyor, gave evidence.—The back was constructed in the customary way; that after the accident the side was bulged and convex on the outside, the cleets broken outwardly; that the point of the greatest convexity was in the lowest tier of tie-rods, and that the rupture of the side tore away the bottom, and that the cause of the accident was insufficiency of the tie-rods both as regards the quality of material and the method of connexion, by means of hooks; that all iron loses 75 per cent. of its strength by being hooked, (as shown in a series of experiments instituted especially for the purposes of this trial, by Mr. Heather, M. A. of the Royal Military Schools, with the proving machine, at the dockyard, Woolwich;) that by calculation the pressure on the entire side of the vat was 70 tons; and, deducting for the duty done by the bottom and sides, there would be a pressure of 6 tons on each tie-rod, supposing it possible to insulate each rod, but the side being made rigid, it was not possible so to do; that the tie-rods were equal to a strain of 2 tons only, and broke with $6\frac{1}{4}$, as shown by experiment; that after the bursting, the pressure of the fluid on the back would rapidly diminish, and would not increase.

Mr. Heather, M. A. of the Royal Military Academy, Woolwich, by a working model proved that, if any fluid issues from an aperture in the side of a vessel, the pressure on that side is diminished, being consumed in the motion of the fluid; that the principle of hooking ties together is essentially bad, in consequence of the cross strain on the fibres of the iron, to the amount of 75 per cent. on all iron; and that the accident occurred in consequence of the insufficiency of the iron tie-rods, as regards quality and construction.

Mr. Davidson, Civil Engineer, gave evidence in confirmation of the above.

The inquiry lasted nine days, and the arbitrator gave his award for the defendant.

The points of this case are especially interesting as regards the common method of hooking ties together, thereby causing a loss of strength, and the wide discrepancy between the experiments performed at *Woolwich Dockyard* and by the *ordinary testing machines at foundries.*

Experiments made at H. B. M. Dockyard, Woolwich, with Messrs. Bramah's Hydraulic Press, in January, 1852, *showing the weakness of hooks.*

COMMON ENGLISH ROUND IRON, 1 3-16 INCHES DIAMETER.

No. 1.—Hooked.

Strain of 4 tons, no effect.
“ 5 “ opened $\frac{1}{8}$ of an inch.
“ $5\frac{1}{2}$ “ “ $\frac{1}{4}$ “
“ 6 “ “ $\frac{3}{8}$ “
“ $6\frac{1}{4}$ “ “ $\frac{1}{2}$ “
“ $6\frac{1}{2}$ “ “ $\frac{5}{8}$ “
“ $6\frac{3}{4}$ “ “ 13-16 “
“ 7 “ “ 15-16 “
“ $7\frac{1}{4}$ “ broke.

No. 2.—Straight (same piece).

Strain of 10 tons, no effect.
“ 16 “ “
“ 18 “ lengthened 5-16 in 2 ft.
“ 20 “ “ 11-16 “
“ 21 “ “ 15-16 “
“ 22 “ “ $1\frac{1}{8}$ “
“ 23 “ “ 1 7-16 “
“ 24 “ “ $1\frac{3}{4}$ “
“ 25 “ “ 2 3-16 “
“ 26 “ “ 3 1-16 “
“ $26\frac{7}{8}$ “ broke.

No. 3.—Hooked open $1\frac{5}{8}$.

Strain of $5\frac{1}{2}$ tons, no effect.
“ 6 “ opened $\frac{1}{8}$
“ $6\frac{1}{2}$ “ “ 5-16
“ $6\frac{3}{4}$ “ “ $\frac{3}{8}$
“ 7 “ “ $\frac{1}{2}$
“ $7\frac{1}{4}$ “ “ $\frac{5}{8}$
“ $7\frac{1}{2}$ “ “ $\frac{3}{4}$
“ $7\frac{3}{4}$ “ “ $\frac{7}{8}$
“ $7\frac{7}{8}$ “ broke.

No. 4.—Straight (same piece as No. 3).

Strain of 16 tons, no effect.
“ 18 “ lengthened 5-16 in 2 ft.
“ 20 “ “ $\frac{3}{4}$ “
“ 21 “ “ 1 “
“ 22 “ “ $1\frac{1}{4}$ “
“ 23 “ “ $1\frac{1}{2}$ “
“ 24 “ “ $1\frac{7}{8}$ “
“ 25 “ “ $2\frac{3}{8}$ “
“ 26 “ “ $3\frac{1}{8}$ “
“ $26\frac{5}{8}$ “ broke.

S. C. CROWN IRON, 1 3-16 INCHES DIAMETER.

No. 5.—Hooked, $1\frac{1}{4}$ open.

Strain of 5 tons, opened 3-16
“ 6 “ “ $\frac{1}{2}$
“ $6\frac{1}{2}$ “ “ $\frac{1}{2}$
“ 7 “ “ $\frac{7}{8}$
“ $7\frac{1}{2}$ “ “ 1 1-16
“ 8 “ “ $1\frac{1}{2}$
“ $8\frac{1}{4}$ “ straightened out.

No. 6.—Straight (same piece).

Strain of 15 tons, no effect.
“ 17 “ 11-16 in 2 feet.
“ 20 “ 1 “
“ 22 “ $1\frac{1}{2}$ “
“ 24 “ $2\frac{1}{4}$ “
“ 26 “ $6\frac{3}{4}$ “ reduced to $\frac{7}{8}$ diameter and broke.

BEST MITRE IRON, $1\frac{1}{8}$ INCHES DIAMETER.

No. 7.—Linked.

Strain of	15	tons,	stretched $\frac{1}{3}$	in 3 feet.
"	16	"	" 3-16	"
"	17	"	" $\frac{1}{2}$	"
"	18	"	" 11-16	"
"	19	"	" 1	"
"	20	"	" $1\frac{1}{4}$	"
"	21	"	" $1\frac{5}{8}$	"
"	22	"	" 2	"
"	23	"	broke.	

No. 8.—Straight (same as No. 7).

Strain of	23	tons,	stretched 3-16
"	24	"	" 7-16
"	25	"	" $\frac{3}{4}$ broke.

No. 9.—Same as No. 7, linked.

Strain of	15	tons,	stretched $\frac{1}{8}$	in 3 feet.
"	16	"	" $\frac{1}{4}$	"
"	17	"	" $\frac{1}{2}$	"
"	18	"	" $\frac{5}{8}$	"
"	19	"	" $\frac{7}{8}$	"
"	20	"	broke.	

No. 10.—Straight.

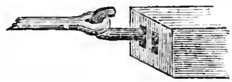
Strain of	20	tons,	no effect.
"	21	"	stretched 1-16
"	22	"	" $\frac{1}{4}$
"	23	"	" $\frac{3}{8}$
"	24	"	" 9-16
"	25	"	" 1
"	$25\frac{1}{2}$	"	broke.

MR. WEBB'S IRON, 1 3-16 INCHES DIAMETER.

No. 11.—A Double Hook.

Strain of	2 tons,	1 hook opened:	2d hook.
"	2 1-16	"	none.
"	3 1-16	"	1-16
"	4	broke.	

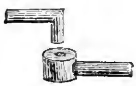
No. 12.



Strain of	2	tons,	no effect.
"	3	"	1-16 opened.
"	4	"	3-16 "
"	5	"	$\frac{1}{2}$ "
"	6	"	$1\frac{1}{8}$ "
"	$6\frac{1}{4}$	"	broke.

MR. TOWNS' IRON MITRE, ROUND, 1 5-16.

No. 13.—Flat Eye, Hook, and Key.



Strain of 8 tons, no opening.
" 16 " broke at angle.

Note.—As (1 5-16)^2 : 16 :: (1 3-16)^2 : 13.
(Iron. Tons. Iron. Tons.)

No. 14.—Same piece straight.

Strain of 30 tons, stretched 1-16 in 10 in
" $30\frac{7}{8}$ " broke.

Note. As (1 5-16)^2 : (1 3-16)^2 :: 30 : 24 6-11
(Tons. Tons.)

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*Experiments with the Submarine Telegraph.**

On Monday last, by permission of the Directors of the Submarine Telegraph between England and France, a series of interesting experiments were made by Mr. Reid, telegraph engineer, of University street, London, for the purpose of testing a pair of double-needle instruments and two new batteries which he had constructed. One of these instruments was placed in the Company's office at Dover, and the other in the French office at Calais, with a battery to each. Two of the submarine wires were then connected with the instruments, and put in circuit with the batteries. The length of the submarine cable in the Channel is about 24 miles, and

* From the London Mechanics' Magazine, for March, 1852.

about five miles of land telegraph on each side, making, in round numbers, a circuit of 68 miles. The battery that was to work this distance formed a strong contrast to the present battery now in use, the length being only 4 inches by $1\frac{1}{2}$ deep, and the weight 1 lb. 5 oz., while the old common battery used on the lines is 36 inches long, $7\frac{1}{2}$ inches wide, $8\frac{1}{2}$ inches deep, and weighs 64 lbs. Some of the telegraph clerks in the office smiled incredulously when Mr. Reid connected the miniature battery with the instrument, but were surprised to find the signals to and from Dover and Calais quite equal to the signals they were receiving from their former batteries. The next experiment was for the purpose of testing an improvement in the double-needle instrument, and will require the utmost stretch of faith on the part of our readers to believe. It was as follows: The miniature batteries were removed from the instruments on each side of the Channel, and a piece of zinc, three-fourths of an inch square, and a piece of silver to correspond, were then introduced into the mouth of the operator at the office in Dover, and instructions sent to do the same at Calais. The wires attached to these pieces of metal were then connected with the instruments, and by this simple means, and by the simplest of all batteries, the telegraph clerks sent several messages to and fro from England to France. The next experiment was similar to this, only a larger piece of zinc and a larger piece of silver were introduced into the mouth of the operator. The result was an improvement of the signals. The next day, March 2, the experiments were repeated with the same success. The instruments with the miniature batteries transmitted all the commercial messages, price of stock, funds, &c., till 1 o'clock, when they were packed up and sent to London. It was thought that during these operations the miniature battery would become exhausted; on the reverse, it improved, and seemed perfectly to maintain its character. From these experiments we may conclude a new revolution is in progress with telegraphs and batteries. They will become more simple, more easy to understand, and will eventually not only become as familiar as household words, but familiar and useful as household servants.

An Account of the Progress made in the Drainage of Haarlem Meer during the last year. By T. Grainger, C. E.*

This short paper, in continuation of Mr. Grainger's description of the drainage of Haarlem Meer, in North Holland, was read by the Secretary. After describing the difficulties to be encountered in the prosecution of this great undertaking, from the size of the lake, and principally from the circumstance that its level, even at the surface, was considerably below that of the sea, so that the whole of the water had to be raised to such a height as would enable it to reach the sea by its own gravity, Mr. Grainger alluded, in general terms, to the various works undertaken to effect the object in view, such as the canal, 33 miles long, 124 to 147 feet in width, and 10 feet in depth, with which the lake had been surrounded to convey the pumped-up water to the sea—to receive the drainage of the district—and to maintain the internal water communication

* From the London Civil Engineer and Architect's Journal, April, 1852.

previously afforded by the lake itself—and also to the three gigantic steam engines, 360 horse power each, erected at different points of the lake, giving motion to 27 pumps, which raise 186 tons of water at each stroke. The canal and all the other preliminary works having been completed, the pumping was commenced in May, 1848, from which date to 30th April, 1851, the lake had been lowered 7 feet 3 inches, which was the state of matters when the subject was last brought before the Society. During the months of May, June, July, August, September, and October, very satisfactory progress was made, notwithstanding that a considerable quantity of rain fell in August and September, the level reached at the end of October being 9 feet 7·74 inches below the original surface, or at an average rate of 4·79 inches per month. In November a great quantity of rain and snow fell, raising the level about 4 inches; and in December the weather was still unfavorable, so that at the end of that month the level stood at 9 feet 5·58 inches below the original surface, or a total gain since April 30th of 2 feet 2·58 inches, or 3·32 inches per month. This progress may appear to be inconsiderable; but, when it is recollected that the lowering of the lake one inch involves the raising of upwards of four millions of tons of water, and allowing for the rain and snow falling during these eight months, there could not have been less than 186,000,000 tons of water pumped up during that period, the performance will appear great indeed. To give a better idea of this, it was stated that 186,000,000 tons is equal to a mass of solid rock one mile square and 100 feet high, allowing 15 cubic feet to a ton. The average progress has been less last year than what it was in the preceding one; but this is readily accounted for by the *increased lift* of the pumps, and by the difficulty of forming the channels which lead the water to them. At the commencement of these operations, the average depth of the lake was 13 feet 1·44 inches, and as 9 feet 5·58 inches have been pumped out, there only remained at the end of December last an average depth of 3 feet 7·786 inches. It is therefore trusted that the drainage will be completed, if not in the autumn of this year, at least in the summer of 1853. A paragraph has been going the round of the newspapers about disastrous accidents to the boilers, which will delay the completion of the works for two or three years. It was stated that there were no grounds for such rumors, as the official report for January, which Mr. Grainger had received, mentioned that the boilers of only one of the engines (the Lynden) were out of repair, and that it was expected that these would be repaired by February; so that, by this time, it is hoped that the whole of the engines are again at work.—*Proc. Roy. Scot. Soc. Arts, March* 8, 1852.

AMERICAN PATENTS.

List of American Patents which issued from April 6th to April 27th, 1852, *(inclusive,) with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improved Lock;* Albert Betteley, Boston, Massachusetts, April 6.

Claim.—"What I claim as my invention is, 1st, Holding the tumblers rigidly, so that they cannot be moved when the keyhole is exposed, by means of a cam placed on the same shaft with the cam which moves the bolt.

"2d, I claim so arranging the tumblers with the key, that the tumblers will form themselves into the right position, so that the bolt can be withdrawn, by dropping by their own weight, or being pressed by springs upon the key, as herein above described."

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2. For *Improvements in Saw Mills;* William C. Bronson, Erwin, New York, April 6.

Claim.—"What I claim as my invention is, the construction of a saw frame or gate of metal tubes, constituting the guides as well as the uprights of said frame, and cross pieces or heads united to said uprights, in the manner set forth.

"I also claim the arrangement of the cross hooked bar and hooks on the ends of the saws, in combination with the sustaining side bars and upper open plate, for the purpose and in the manner substantially set forth in the foregoing specification and accompanying drawings."

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3. For *Improvements in Spinning Bait for Catching Fish;* John T. Buel, Whitehall, New York, April 6.

Claim.—"Having thus described my improved revolving fish or fly, I wish it to be distinctly understood that I do not claim what is called a spoon, minner, or the common fly, all these having been used before; but what I do claim as new is, 1st, Constructing a bait with an air-tight chamber, which chamber is provided with an aperture or apertures for the admission of air when fishing light, near or on the surface of the water, and for the admission of water when it is desired to fish deep under the surface of the water, substantially as described.

"2d, I do not claim passing the line loosely through a cork or float, that the float may move freely upon the line; neither do I claim attaching a spinning bait to the line by means of a swivel; but what I do claim is, passing the line through a tube in the body of a spinning bait, in the manner substantially as described, to enable the bait to twirl freely without twisting the line."

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4. For an *Improvement in Stone Cutting Machines;* John W. Cochran, Williamsburg, New York, April 6.

Claim.—"What I claim as my invention is, 1st, Cutter jaws or their equivalent, combined with and carrying a cutter across the stone, in the segment of a circle, the cutter being so set that the part of its periphery in contact with the stone, when cutting, inclines towards, and the part of the periphery opposite thereto, from the axis or centre of motion of the cutter jaws, for the purpose set forth.

"2d, The application of revolving cutters to dressing stone, moving and cutting in a curved line across the stone, and on a convex edge of the undressed portion of the surface formed by the line of cut, and cutting towards the centre of motion of the cutters in such curved line.

"3d, The combination of a rock shaft with cutter jaws, to carry the cutters over and clear from the undressed portion of the stone, substantially as described and for the purposes set forth.

"4th, The combination of the rock shaft, guide table, and friction rollers, and their equivalents, substantially as described and for the purpose set forth.

"5th, The combination of the rock shaft and cam and roller, to produce the rocking or trembling motion, substantially as described."

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5. *For an Apparatus for Closing Doors;* Minard Thurston Cooper, Ballston Spa, New York, April 6.

Claim.—"What I claim as my invention is, the combination of the heavy roller upon a vibrating arm with the turning railway or inclined plane, the former attached to the door, and the latter to the casing, and the whole operating substantially in the manner and for the purpose herein described."

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6. For an *Improvement in Horse Collars;* Henry B. Latham, Huntington, New York, April 6.

Claim.—"1st, I claim the spring 9, and staples 10, to connect the upper ends of the hames, as described and shown.

"2d, I claim so constructing and fitting the collar and hame, that the hame shall work or slide on the collar by any jerk or lurching of the harness, for the purpose of relieving the animal; said collar and hame being fitted with the rivets 1 and 2, or their equivalents, to allow the one to slide on the other, and being connected by the bolts 5, or their equivalents, as described and shown."

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7. For an *Improved Method of Attaching Roses for Knobs to Doors, &c.;* Nathan Matthews, Assignor to Richard Edwards, David A Morris, and Nathan Matthews, Pittsburg, Pennsylvania, April 6.

Claim.—"I do not claim the mere employment of a dovetail joint, for securing the circle plate in its place; but I claim as new the combination, substantially as described, of the circle plate, having dovetails on its inner face, the dovetails, which are fast on the door or other object, and the shank or socket of the knob, or what is equivalent, any spindle or shaft, attached to the knob or handle."

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8. For an *Improvement in Coat Forms;* William B. Olds, Meriden, Connecticut, April 6.

Claim.—"What I claim as my invention is, the bow, C, substantially as described, suspended by a shank at a point distant horizontally from its vertex, on a pivot or its equivalent, which is stationary in a bracket, or any suitable standard or pendant, so placed or constructed as to allow the bow to turn round in any direction, as and for the purposes herein set forth."

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9. For an *Improvement in Moth Traps to Bee Hives;* Ebenezer W. Phelps, Newark, Ohio, April 6.

Claim.—"I claim the peculiar construction of the moth trap as herein described, composed of a slide, having the centre groove and two side grooves, and the metallic hinged cover, arranged all as set forth in the specification."

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10. For an *Improvement in Buttons, Studs, &c.;* David Rait, City of New York, April 6.

Claim.—"What I claim as my invention is, making a stud, button, or other similar fastening or article of jewellery, in two parts, one part carrying a tube, and the other part with two snap springs, operating in the manner substantially as set forth."

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11. For an *Improvement in Smut Machines;* Daniel Shaw, Cheshire, Ohio, April 6.

"The nature of my invention consists in an improvement, by which the light grain and cheat is perfectly and effectually separated from the smut, dust, chaff, and other impurities, at one single operation."

Claim.—"Having thus fully described the construction and operation of my combined smut and grain separator, what I claim therein as new is, the offset, that is to say, enlarging the space of the hollow trunk on the opposite side thereof from that at which the grain is admitted, in combination with the screen e, spout f, and the passage and valve g', for taking the dust, &c., into the fan case, whereby the cheat and light grain, which will pass up the spout, with the impurities, is effectually separated, and delivered through the spout f, substantially as herein fully set forth."

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12. For an *Improved Harpoon;* J. D. B. Stillman, City of New York, April 6.

Claim.—"I do not claim making the flukes separate from the point, or causing the latter to enter deeper than the former into the body of the whale; but what I do claim as my invention is, the combination of the sliding and unlatching flukes with the lance, and the lines, or their equivalents, by means of which the point is driven deeper by the drag or traction on the line, substantially in the manner herein described."

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13. For *Improved Mechanism for Actuating an Adjustable Eccentric,* Matthew Stubbs, Cincinnati, Ohio, April 6.

Claim.—"Having thus described the nature of my improvements in the valve gearing of steam engines, I wish it to be understood that I make no claim to an adjustable sheeve,

nor to the use of a screw in this connexion; but what I claim herein as new are, the herein described devices for the adjustment of an eccentric sheeve, that is to say, the sheeve stock, arranged so as to traverse a bed-plate at right angles to the shaft or axle, and operated by a hand bar through the medium of suitable levers, and yoke, connected with a sliding collar, from which projects a rack, which gears into a pinion upon the screw, which actuates the sheeve; and this I claim, whether or not the same be combined with the vibrating arm and shifting pin, as herein represented, for variation of the throw."

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14. For an *Improvement in Grain Separators;* John Thompson, Chili, New York, April 6.

Claim.—"Having thus fully described my improved threshing machine, what I claim therein as new is, the novel arrangement for separating the grain from the straw, by which the slats provided with teeth have a rotary and lateral motion, said motion produced substantially as described, or in any equivalent manner, in combination with the inclined slats, whereby, by their combined action, the grain is perfectly and rapidly separated from the straw, operating in the manner and for the purpose herein fully set forth."

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15. For an *Improvement in Boot Jacks;* Sardis Thomson, Hartsville, Massachusetts, April 6.

Claim.—"Having thus described my invention, what I claim as new is, 1st, The heel gripper and stirrup, in combination with the lever, to draw the stirrup over and hold the toe of the boot, in the manner and for the purpose set forth.

"2d, I claim the movable heel gripper, in combination with the connecting rod and stirrup, constructed and operating substantially the same as described and represented."

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16. For an *Improvement in Seed Planters;* Jesse Urmy, Wilmington, Delaware, April 6.

Claim.—"Having thus fully described my improved machinery for seeding, what I claim therein is, the jointed tooth attached to the beam, as shown in fig. 7, in combination with the swiveling bifurcated spout, to direct the corn as above specified, for ribbed seeding.

"I also claim the combination and arrangement of the counter with the clutch, as described, so that the counting shall stop when the seed is not delivered.

"I also claim the finger register and its appurtenances, as above described, for regulating the quantity of seed delivered.

"I also claim, in combination with the seeding apparatus, the pulverizer, for guano, &c., constructed and arranged as set forth."

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17. For *Improvements in Rails and Car Wheels;* John Valentine, City of New York, April 6.

"My invention consists in a new and improved method of constructing wooden railroads, and carriages adapted to run upon the same."

Claim.—"What I claim, therefore, as my invention is, the guide wheels, in combination with the rail, constructed as described, and the carriage; said wheels having their circumferences beveled, so as to expose two surfaces to roll upon; one to project against the side of the rail, and the other to come in action upon the surface of the inner strip forming part of the chair, when the guide wheels become burthen wheels, as described; the whole being constructed and operating substantially in the manner herein set forth."

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18. For an *Improvement in Cultivators;* T. J. Ball and John Post, Pittsfield, Michigan, April 6.

Claim.—"What we claim as our invention is, the construction of the long metallic inclined blades on the after part of the machine, for cutting the sods and lumps, and pulverizing the ground, as set forth."

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19. For *Improvements in Drop Punches;* Solomon Andrews, Perth Amboy, New Jersey, April 13.

"The nature of my invention consists in the peculiar construction of the drop punch and the mode of lifting and discharging it."

Claim.—"I do not claim constructing the hammer with a long stem, and making the same serve as guides; but I claim as my invention, the hammer or drop, provided at the same time with a stem to serve as one of its guides, and one guide on each side, at or near its lower end, substantially as herein specified.

"I also claim as my invention, the manner of lifting and discharging the hammer, or drop, by means of the cogs in its stem, and the pinion operating therein; the fall of the hammer or drop, bringing the said pinion into gear with the motive power, and its upward motion releasing or discharging it threfrom, at any given point, substantially as herein described."

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20. For *Improvements in Hinges;* William Baker, Utica, New York, April 13.

Claim.—"I do not claim as new, simply constructing the window blind hinge, with its screw plates so arranged as to be secured to the back of the blind and the outside of the window casing; but I claim the bridge or inclined plane at the base of the pin, and the corresponding elongation of the eye, operating upon and in connexion with the hook and catch attached and connected in the manner described; the whole forming a fastening, and the mode of operating the same; the fastening taking hold of, and pulling directly upon the window casing and the blind, and thus relieving the hinge as described.

"I claim the use of the bridge, or inclined plane, at the base of the pin, and the elongation of the eye as described, for disengaging the blind fastening independent of its connexion with my fastening, as above described, and whether the fastening is connected with the hinge or not; the whole being constructed and arranged substantially in the manner above set forth."

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21. For an *Improvement in Machines for Tonguing Boards;* Ransom Crosby & Henry D. Edgecomb, Assignors to Ransom Crosby Jr., City of New York, April 13.

Claim.—"Having thus fully described our apparatus, what we claim therein as new is, the arrangement of two sets of stationary vibrating cutters for tonguing boards in separate stocks, substantially as herein described, with a space between them for the escape of shavings, the sides of the stock being substantially parallel to the face of the board and each other, and the surfaces of their soles being substantially perpendicular thereto, the plane irons being inclined in the usual way, to the soles and backs of the stocks and the cutters, in their length, being substantially parallel to the sides thereof. We are aware that two sets of cutters, in separate stocks, have been differently arranged and for an analogous purpose, and we therefore do not claim them, except in the arrangement and position, substantially as above described."

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22. For *Improvements in the Method of Welding Steel, &c., to Cast Iron;* Mark Fisher and John H. Norris, Trenton, New Jersey, April 13.

Claim.—"Having thus described our improved apparatus for the manufacture of articles of cast iron, with steel or wrought iron welded thereto, what we claim as our invention is, first, the metal box or frame for sustaining the steel in place, and forming the cell below it; and, secondly, securing the steel in place by means of the clamps, in the manner above described."

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23. For *Improvements in Mills for Curvilinear Sawing;* James Hamilton, City of New York, April 13; patented in England, June 1, 1848.

"The invention consists, first, of means of supporting timber, when being cut to various bevels.

"Secondly, The invention consists of chucks, or apparatus, for holding timber at the ends, when being cut or sided, and in supporting such chucks.

"Lastly, The invention consists of improvements in apparatus for indicating the directions or bevels to which timber is to be cut."

Claim.—"What I claim as my invention is, connecting the supporting roller with the lever which forces it up against the under side of the log, by means of a joint and a segment slot, and securing bolt, or the equivalents thereof, substantially as specified, so that the said roller can be inclined in any desired direction from a horizontal line, to suit the inclination of the underside of the log, and there secured, to give efficient support, as set forth.

"I also claim extending the chucks for supporting the ends of curved logs below the head and tail blocks, so that the ends of such logs in siding may be supported below the surface of the head and tail blocks, to bring the upper curved part within the range of motion of the saw, substantially as specified, when this is combined with the middle supporting rail, on which the lower part of the chucks rest, and by which they are supported during the operation, as set forth.

"And, finally, in the method of indicating the bevels and keeping the log to them as it is being sawed, I claim the index hand, whose axis of motion is in a line, or nearly so, with the axis of rotation of the log, substantially as specified, in combination with either of the side levers, which have the same axis of motion as the index hand, and the adjustable or shifting inclined ways, substantially as specified, so that as the carriage advances with the log, the passage of the side lever (whether on one side or the other,) on the inclined plane set to the required bevel, will shift the index hand and indicate the true bevel, to enable the operator to turn the log to correspond, as set forth."

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24. For *Improvements in Machinery for Making Casks;* James Hamilton, City of New York, April 13.

Claim.—"Having thus specified the various parts of my invention, and the manner of constructing and using the same, what I claim as my invention is as follows, viz: The sawing of two staves from one block, by means of two saws, which in succession enter the same kerf, then, in succession, diverge in opposite directions, and finally converge and pass out of the same kerf, substantially as specified, the two saws being mounted substantially as specified, so that they can be moved laterally in opposite directions, in combination with the templates or their equivalents, for giving the required lateral motions to the saws, as the block of wood is moved forward towards the saws, substantially as specified; in the machinery for boring holes for dowel pins, I claim the arrangement of the mandrels carrying the bits on separate slides, to admit of varying their distance apart, substantially as specified, in combination with the reversible fence or gauge, hung to a rock-shaft, mounted on a slide between the mandrels, and provided with the means of adjustment, substantially as specified, by means of which the bits can be set at pleasure, to bore the holes at any desired distance apart, and on the two edges, to correspond, the distance being gauged from the same end, with the view to economize timber, as specified.

"In the machinery for jointing staves, I claim, in combination with the circular saw, and the hinged carriage, which is governed by guides, to determine the form to be given, as described, the employment of the gauging apparatus to determine the quantity of stuff to be cut off, and the gauge piece with its two points, and made adjustable on the carriage, substantially as specified, by means of which combination, the quantity of stuff to be cut away from each edge, is regulated to prevent waste, and an equal width of the two ends secured, when cutting the second edge, as set forth.

"In the machine for setting up the staves and driving on the hoops, I claim the spring arms jointed to the weight or head on the sliding shaft, or the equivalents thereof, the said arms being formed with lips inside to support the hoop whilst setting up the staves, as specified, when the said arms are combined with the cam plate, or the equivalent thereof, for the purpose of liberating the arms from the hoop, that they may be employed for driving on the hoop, substantially as specified.

"And, finally, in the machinery for turning the heads, I claim, in combination with the face chuck for receiving the head, and the clamping piece for clamping it against the chuck, substantially as specified, or the equivalents thereof, the employment of the jaws, operated by screws, or their equivalents, for the purpose of forcing together the different pieces constituting the head, preparatory to clamping them on the chuck and turning the head, subtially as and for the purpose specified."

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25. For *Improvements in Looms for Weaving Figured Fabrics;* Barton H. Jenks, Bridesburgh, and Robert Burns Goodyer, Philadelphia, Assignors to Barton H. Jenks, Bridesburgh, Pennsylvania, April 13.

Claim.—"What we claim as our invention is, 1st, The method of moving both picker sticks of a loom simultaneously and at each beat of the lay by the mechanism herein described, or the equivalent thereof, whereby a shuttle may be thrown from either side of the web, at each beat of the lay, and the momentum of the picker motion at one side of the loom is counterbalanced by that of the other picker motion at the opposite side of the

loom, the mechanism operating in such manner, that both the pickers are free to retreat to the outer ends of the shuttle boxes, the instant the shuttle is thrown, substantially as specified.

"2d, The combination of the pattern wheel U, arm W, doubled armed lever R, cross-head M, and stop L, operating substantially as herein set forth, to effect the shifting of the shuttle boxes, as herein set forth.

"3d, The combination of the forked marches, reciprocating levers, pattern drum and evening pin, substantially as herein set forth, to effect the working of the heddles from the shed, as herein set forth.

"4th, The combination of the supplementary arms on the cam shaft and pins upon the star wheel, or the equivalent thereof, operating substantially as herein set forth, to vary the number of changes of which the heddle mechanism is susceptible.

"5th, The combination of a fork and grid motion for effecting the stopping of the loom, when the weft thread breaks, as the shuttle is moving towards one side of the loom with the shifting plate lever, operating substantially as described, for preventing the loom from being stopped by the fork and grid motion, when the shuttle is thrown towards the side of the loom further therefrom.

"6th, The combination of the long rock shaft on the lay, with its arms, toes and levers, and of the chain lever and chain, with the breast beam lever, or the equivalents thereof, operating substantially as described, to effect the stopping of the loom when the shuttle is not in its proper shuttle box, at the time the lay is beating up, and also whenever the shuttle has not been ejected from its box, at the time the lay is completing its back stroke, as herein set forth."

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26. For *Improvements in Reeling Machines;* Elias & Simeon Macy, Laurel, Indiana, April 13.

Claim.—"We do not claim to have invented a self-acting stop motion, to stop the machine when a given length of yarn has been wound upon the reel, this having already been applied to machines similar to ours; but what we do claim is, constructing and arranging the stop motion substantially as described, so that by adjusting it, the length of yarn wound upon the reel before it is stopped may be regulated at pleasure, and all the skeins wound under the same adjustment will have the same length."

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27. For *Improvements in Sewing Machines;* Isaac M. Singer, City of New York, April 13.

Claim.—"Having thus fully described my additional improvements, what I claim therein as new is, 1st, the cut-off friction pad, constructed and operating substantially in the manner and for the purpose set forth.

"I also claim the construction and arrangement of the feeding apparatus, as above described."

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28. For an *Improvement in Seed Planters;* B. T. Stowell and A. Marcellus, Waddam's Grove, Illinois, April 13.

Claim.—"What we claim as our invention is, 1st, the application of the dibbles, &c., constructed and arranged as described, to the peripheries of the wheel, and operating in the manner herein set forth.

"We also claim the peculiar arrangement for feeding the seed to the hills, consisting substantially of the pistons and tubes, regulated by the coiled springs and bars, and operating as herein set forth."

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29. For an *Improvement in an Instrument for Opening Boxes;* George C. Taft, Worcester, Massachusetts, April 13.

Claim.—"What I claim as my invention in the above described instrument for opening boxes is, the tapering score, I, cut in both jaws, but smaller in the upper one, or F, so constructed that when both jaws are driven in between the side and lid of a box, the points of the jaws pass on each side of the nail, which will be griped in the score, I, so that as the jaw, F, is raised to take up the lid, it will draw the nail out of the side, and thus prevent the head of the nail from being drawn through the lid as it rises, while the jaw, G, rests upon the side of the box, substantially as described.

"2d, Is the tapering score, I, in combination with the peculiar construction and arrangement of the jaws, F and G, the latter being furnished with a recess at H, into which the former closes, in the manner and for the purposes herein set forth."

30. For an *Improvement in Seed Planters;* Francis Vandoren, Adrian, Michigan, April 13.

Claim.—"Having thus fully described my improved seeding apparatus and cultivator, what I claim therein as new is, the hollow reversing tooth, constructed in the manner and for the purpose set forth."

31. For an *Improved Oblique Bucket Paddle Wheel;* George S. Weeks, Oswego, New York, April 13.

Claim.—"I do not claim placing the paddles in oblique positions to the axis of the wheel, as this has been done before; nor do I claim two sets of paddles inclining obliquely in opposite directions, and all at the same distance from the centre of the wheel: but what I do claim as my invention is, the arrangement of two series of adversely inclining oblique paddles, one within the other, in the construction of steamboat wheels, substantially as herein set forth."

32. For an *Improvement in the Feed Apparatus of Planing Machines;* Joel Whitney. Winchester, Massachusetts, April 13.

Claim.—"I do not claim gearing the feed rollers with each other, by means of pairs of movable pinions connected to each other and to the feed rollers by links, this having already been done, for the purpose of giving large play to said feed rollers: but having described my improvements, what I claim as my invention is, the arrangement by which the upper feed roll is allowed to yield to any inequalities in the board, and at the same time draw down upon the surface, to which it has yielded, in proportion to the resistance to the cutting tools, that is, connecting the fixed shaft with the vertical sliding bearings of the upper feed roll, by means of the swinging inclined and vertical arms, the gears on the fixed shaft operating the lower feed roll, and also playing into the gears which move the upper feed roll; said latter gears having their bearings in the intersection or joint of the said arms, the arrangement being substantially as herein above set forth."

33. For *Improvements in Submarine Augers;* Norman Blake, Ira, New York, April 20.

Claim.—"Having thus described my invention, what I claim is, forming a pod auger with a hinge joint, E, in combination with connecting wires, substantially in the manner and for the purposes set forth and shown."

34. For an *Improvement in Mattrasses;* Thomas G. Clinton, Cincinnati, Ohio, April 20.

Claim.—"Having thus complied with the Patent Laws of the United States, in the matter of my discovery, treated at length in the specification of description in the drawings annexed thereto, and made part of the same, what I claim is, the use of the hair of hides of cattle, treated after the manner of, or steeped with the hides of cattle in the lime-vats of a tan-yard or other suitable place, as described, with or without other animal or vegetable matter, treated or not treated conjointly therewith, or separately, in the same way; and the use of other animal or vegetable matter, under like treatment and circumstances as described, whether used conglomerately, conjointly, or separately, or their equivalents, when such animal or vegetable matter is of the kinds used for upholstering or sleeping purposes, in the articles of mattrasses, ottomans, cushions, sleeping sofas, sacking bottoms, or analogous articles, whereby a new result is attained, viz: an article obnoxious to bed-bugs, without the necessity of any temporary application of poisionous mixtures thereto; thus furnishing the world with a harmless antidote to a great nuisance, and abolishing the necessity for a great peril to human life in the domestic circle."

35. For an *Improvement in Winnowers;* Thomas J. Doyle, Winchester, Virginia, April 20.

Claim.—"What I claim as my invention and improvements are, 1st, in combination

with the side openings, discharge outlets, or passages, *o o*, diagram, E, the invention, use, and application of the sliding diaphragm, with double sloping bottom, *p p p*, in diagram, E. This diaphragm bottom, as shown and used, has a double slope, or is a double inclined plane outward, inclining from each side of its elevated longitudinal centre.

"2d, I claim the use, application, and arrangement of an adjustable or sliding cheat or smut board, as shown in diagrams, C and F, and the same also in combination with the top screen, No. 1, with side apertures or outlets, *o o*, as shown in diagram, E, for the purpose as herein before fully specified."

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36. For a *Sash Stopper and Fastener;* Charles C. Felton, Dedham, Massachusetts, April 20.

Claim.—"I do not claim the combination of a rocking or vibrating friction plate, a lever spring, and notched plate, as they are arranged in the drawings of the patent granted to B. S. Hadaway; but as I dispense entirely with a lever separate from the rocking friction plate, and make the said plate to operate itself, I claim my improvement of combining the rocking plate, F, and lever, in one single piece, and extending it below the part which rocks on the part, *b*, of the notch of the catch plate, all essentially in manner as described, whereby I greatly simplify the construction of the window catch, and thereby render it not only cheaper in construction, but less liable to get out of order."

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37. For an *Improvement in Protecting Wheels and Axles of Cars, by Incasing them;* A. L. Finch, New Britain, Connecticut, April 20.

"The nature of my invention consists in the employment of metallic cylindrical tubes and casings, in which the axles and wheels of railroad cars are incased and secured, and also allowed to turn freely. The object effected by this invention is, the prevention of the very serious consequences which ensue from the accidents so often occurring on railroads, occasioned by the breaking of the wheels and axles of rail cars."

Claim.—"Having thus fully described the nature and application of my invention, what I claim as new is, incasing the axles and wheels of rail cars within a metallic casing, substantially as and for the purposes herein specified."

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38. For an *Improvement in the Keys of Piano Fortes, Organs, &c.;* William F. Furgang, Albany, New York, April 20.

Claim.—"I claim the improvement of the finger keys of organs, piano fortes, or any other musical instrument played in a similar manner, by constructing a part of every key in such a manner, that when in position on the key board, such part of every key shall be both level and in range with the similar parts of the other keys, so that the running of a finger over the keys of the whole chromatic scale on the key board, may be capable of producing similar effects to those that can now be produced by a similar running of a finger over the lower range of keys of piano fortes as now constructed, substantially in manner and form as set forth in the above specifiation."

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39. For an *Improved Capping of Screws;* Charles T. Grilley, New Haven, Connecticut, April 20.

"My improvement consists in the combination of a brass, copper, or plated cap, with an iron-wood screw, to the head of which it is attached as hereinafter described, in such manner as to unite with the strength and comparative cheapness of an iron screw, an external appearance and beauty, when inserted, similar and in all respects equal to that of screws made wholly of brass, copper, or plated metal."

Claim.—"I do not claim as my invention the adaptation simply of a cap of sheet metal to the particular configuration of any regular or irregular form, by compression, or in whatever other manner the same may be produced; but what I do claim as my invention is, the attachment of a brass, copper, or other suitable metallic cap, to and in combination with an iron-wood screw, substantially in the manner and by the process described in the foregoing specification, (which I conceive to be the only practicable method in which the same can be usefully effected,) whereby, and by means of the successive operations of punching or stamping, the nick is first cut through the shell, and then, after being adjusted to the groove or slot in the head of the screw, the sides thereof are driven down into and made

to press closely against the sides of the slot, leaving the bottom of the groove or slot uncovered, so that the cap, when closed round the head of the screw, will preserve its hold, without liability to be turned or displaced by the screw-driver, which works upon the iron surface at the bottom of the slot, and against the covered sides thereof; thereby furnishing to the public, at a comparatively small cost, a wood screw, having all the beauty and finish of a brass, copper, or plated screw, in combination with the greatly superior strength of an iron one. The invention is equally applicable to steel screws, which may be capped in a similar way."

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40. For an *Improvement in Machines for Drawing Spikes;* Daniel Hale, Hinsdale, New York, April 20.

Claim.—"Having thus explained and described my invention, what I claim is, the shackle, with the arrangement for clasping the head of a spike, for the purpose of drawing it from the cross-tie of a railroad track, in combination with the clevy and the lever, substantially as herein before described and set forth."

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41. For an *Improvement in Apparatus for Raising Water;* N. H. Lebby, Charleston, South Carolina, April 20.

"The nature of my invention consists in constructing the turbine with ribs on the outer face of its upper disk, which ribs, working under a cover to the wheel, cause, by the centrifugal effect produced while in motion, a void to be formed at or about the centre, the tendency of which will be to relieve the wheel of its weight, and consequently reduce the running friction."

Claim.—"What I claim as my invention is, constructing the wheel or turbine with exterior ribs, of any suitable number, size, or shape; the said ribs operating in combination with a cover or its equivalent, in the manner and for the purposes substantially as set forth."

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42. For an *Improvement in Refrigerators;* Andrew Maish, Cincinnati, Ohio, April 20.

Claim.—"I am aware that ice safes have been made with hollow shelves for water, but these are practically objectionable, on account of their costliness, cumbersomeness, difficulty of cleaning, and liability to twisting, either from the congelation of the water, in the event of the discharge becoming choked, or from the hydrostatic pressure: but what I claim therein as new is, the application, as herein described, to an ice safe or refrigerator, of a crimped, convoluted, or corrugated form, to the shelves, in order (in addition to combining strength with lightness of construction) to capacitate them for the collection, retention, and discharge of the water, which results both from the ice and from the atmospheric moisture within the case."

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43. For an *Improvement in Brick Machines;* Jesse Samuels, Allentown, Pennsylvania, April 20.

"My invention consists, 1st, in an improved feeding arrangement, by which the desired quantity of clay to fill the moulds can be regulated to a nicety, in connexion with a plunger, which partially condenses the clay into the moulds preparatory to pressing.

"2d, In the novel device or arrangement for clamping, removing the brick from the moulds, and placing them on a platform or apron, which I denominate a carrier."

Claim.—"Having thus fully described my invention and the manner of constructing the same, what I claim therein as new is, the manner of feeding the clay to the moulds, by means of the cut-off, in the hopper case, with the scraper, for heaping the clay under the plunger, in connexion with the plunger, operated as described, for partially condensing the clay into the moulds preparatory to pressing, substantially as described.

"I also claim the carrier, for clamping and removing the brick from the moulds, consisting of the clamp, and back plate, for clamping the brick, and the spring, and tumbler shaft and trigger, or their equivalents, arranged substantially as described, and operated upon by three stationary pins, substantially in the manner and for the purpose herein fully set forth."

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44. For an *Improvement in Rotary Pumps;* Henry C. Spalding and Gage Stickney, Hartford, Connecticut, April 20.

Claim.—"Having thus described the nature and operation of our invention, what we

claim as new is, the spiral flanch, working within a circular case, said flanch being constructed as described, in combination with the sliding valve, the spiral flanch and valve, operating in the manner and for the purpose substantially as herein shown and specified."

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45. For an *Improvement in Balance Gates;* William C. Van Hoesen, Leeds, New York, April 20.

Claim.—"Having thus described the nature and operation of my invention, what I claim as new is, the method of opening and closing the gate, substantially as herein shown and described, viz: by means of the ropes or cords passing over the semi or half pulley, and attached to the small upright. said pulley being attached to one of the side pieces, the gate being hung upon pivots, and balanced by the weight or counterpoise, the several parts being operated as set forth."

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46. For an *Improvement in Tailors' Measures;* William T. Wells, Shelbyville, Tennessee, April 20.

Claim.—"What I claim as my invention is, the graduated straps, No. 1, No. 2, and No. 3, in connexion with the several centres about which they respectively turn, and with the graduated arcs, the said centres being arranged substantially as herein set forth, and for the purposes specified, using for that purpose the aforesaid instrument, or any other substantially the same, and which will produce the intended effect; but I disclaim having invented the tape measure or the elastic square, designated as No. 3, underneath the main instrument."

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47. For an *Improvement in Hame Tugs;* R. B. Whipple, Cleveland, Ohio, April 20.

Claim.—"What I claim as my improvement is, the formation of the hame tug, by means of the two metallic plates, fitted together so as to embrace the buckle, loop, and cleft, substantially in the manner herein set forth."

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48. For an *Improved Reflecting Spirit Level and Square;* Francis Wilbar, Roxbury, Massachusetts, April 20.

Claim.—"I would remark, however, that I deem the cubical block, with its two mirrors and two spirit levels, arranged as seen in the drawings, the most convenient form; and it is this instrument, or combination of block or frame, two mirrors, and two spirit levels, or what is equivalent to the two levels, viz: a spherical surface level, I claim as my invention."

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49. For *Improved Devices for Casting Circle Plates, Roses, &c., with Dovetailed Grooves;* Nathan Matthews, Assignor to Richard Edwards, David A. Morris, and Nathan Matthews, Pittsburg, Pennsylvania, April 20.

Claim.—"What I claim as my invention is, forming the dovetails in circle plates by dovetail pieces, which are withdrawn lengthwise from the recesses, the said withdrawing being performed by attaching the dovetail pieces to levers, F F, within the cylinder, E, or body of the mould, the said levers being moved by a rod passing through the side of the cylinder or body of the mould, substantially as herein set forth."

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50. For an *Improvement in Railroad Car Brakes;* Benjamin Kraft, Reading, Pennsylvania, April 20.

Claim.—"I do not claim the mere application of friction rollers, *c c*, as such are not new: nor yet do I claim, independent of the means and manner shown, the employment of a stop, to prevent the advance rubber from being raised by the wheel, or exclusively of itself, the adoption of a spring to reduce the shock. But what I do claim as my invention is, the combination and arrangement of the sliding bar, E, made as described and represented in fig. 1, with the rollers, *e f*, and suspended frame, B, attached to a hanger, C, by a centre pin, *i*, on which is adjusted the spiral spring, *d*, said frame being made, arranged, and operated in the manner and for the purpose herein set forth."

51. For *Improved Valves for Steam Engines;* Matthias W. Baldwin, Philadelphia, Pennsylvania, April 27.

"My invention and improvement consist in arranging in a suitable valve chest, a duplex valve, (one part of which is actuated by valve gear in the usual manner,) and its office is to admit steam directly from the boiler, to actuate the other part, which opens and closes the passages, for steam to pass into or out of the cylinder."

Claim.—"What I claim as my invention is, the arrangement in the valve chest of a steam engine of a duplex valve, one part of which is actuated in the usual manner, by valve gear, to admit steam from the boiler to act directly on the other part, and force it to open and close the steam or exhaust passages, substantially as herein described."

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52. For an *Improvement in File Cutting Machinery;* John Cust Blair, Pittsburg, Pennsylvania, April 27.

Claim.—"Having thus fully described my invention for cutting files, I would state, that I do not claim a pattern for regulating the depth of the cut of the chisels; but I do claim the combination of the pattern, located between the cam and the chisel carriage, in the manner herein described, with said cam and carriage, and the file carriage, by which the pattern is moved; the whole arranged and operating substantially in manner and for the purpose set forth."

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53. For an *Improvement in Shuttles for Weaving Hair Cloth, &c.;* Daniel L. Dewey, Hartford, Connecticut, April 27.

Claim.—"What I claim as my invention is, the combination of the sliding bar with the springs, when used in connexion with stops attached to the shuttle boxes, or other convenient fixtures, so that the motion of the shuttle will slide the bar in such a manner, that when one of the springs drops one piece of the woof or filling, the other spring will receive and confine another at the other end, so that the pieces may be carried through alternately from each side, and released or dropped in the right position to be beat up, when the whole is constructed, arranged, and combined, substantially as herein described."

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54. For an *Improvement in a Hold-Back for Sleds;* Perry Dickson, Blooming Valley, Pennsylvania, April 27.

Claim.—"I do not claim connecting the dogs with and operating them by the backward pressure of the tongue; but I claim as my invention, as being more simple than the ordinary means by which this is effected, attaching the dogs to the roller rigidly, instead of to the runners as is usual, and connecting the tongue to the said roller by hinges or analogous joints, in such a manner that the backward motion of the tongue, in relation to the body of the sled, turns the roller on its axis, and forces the points of the dogs, so attached to it, into the snow or ice of the road, substantially as and for the purpose herein set forth."

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55. For an *Improvement in Smut Machines;* John M. Earls, Troy, New York, April 27.

Claim.—"Thus having fully described my machine, I wish it to be understood that I do not claim as new a "perforated case," the same having been heretofore in use; neither do I claim a spike rubber; nor a ventilator with spiral arms; nor scourers made of sheet or other metal; nor do I claim the oil box at the top of the machine, nor the oil pipe for the lower bearing of the shaft. But what I do claim as new is, 1st, The projecting screen chambers, in combination with the arrangements for separating the rubbing chamber from the fan chamber, whereby the grain is prevented from being affected by the blast from the fan chamber while it is passing through the rubbing chamber, and is only brought in contact with the current of air where it ascends to take away the chaff and other impurities, substantially as herein set forth.

"2d, I also claim, in combination with the scouring surfaces, the beating forks, for the purpose of beating the grain and breaking the hulls, while falling from the rubber to the scourers, whereby the berries are more effectually cleaned from adhering impurities, as herein set forth."

56. For an *Improvement in the Relief-Steering Apparatus;* Nathaniel T. Edson, New Orleans, Louisiana, April 27.

Claim.—"Having thus described the nature of my invention, the way in which it is constructed, and its operation, I do not claim any particular part of the apparatus as new; but what I claim as my invention is, the combination of the forked and unforked pawls with a single ratchet, and with rubbers placed face to face, and on the same side of the wheel.

"2d, I claim the combination of the spring, the arms, and the cap piece, with the relieving springs, whereby the pawls are supported with sufficient firmness, but at the same time permitted to have sufficient play to admit of the action of the said relieving springs, all as substantially set forth, represented, and described."

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57. For an *Improvement in Railroad Switches;* John F. Klein, Trenton, New Jersey, April 27.

Claim.—"What I claim as my invention is, the bars or shifters, constructed, arranged, and connected to the switches of a railroad, in the manner and for the purpose substantially as described, so that if the train run in either direction, and the rudder be placed in either position, as described, and if the switch or switches are not in a proper position, the rudder will act upon the shifters and move them gradually as the train approaches, so as to move and place the switches in such a position that the train may pass on unimpeded, without the risk of running off the track."

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58. For an *Improvement in Gins for Long Staples of Cotton;* Calvin Willey, Jr., Chicago, (now deceased,) Assignor to himself and Urial Walker, Babcock's Grove, Illinois, April 27.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, regulating the feed of a cotton gin for ginning Sea Island cotton, by means of an endless apron, which may be set to or from the feed rollers, to suit the quality of the staple, and the quantity to be fed in to be cleaned, and still be driven by the same mechanical movement, substantially as herein described.

"I also claim, in combination with the covered feed rollers which receive the material from the apron and carry it into the machine, the series of alternate brushes and elastic beaters on the same shaft, for combing out the fibre and knocking off the seed, whilst it is still held by said rollers, as herein substantially set forth and described.

"I also claim, in combination with the inclined chamber, through which the material is driven by the blast from the wings of the beaters, the inclined chamber having a cross blast through it from the fan blower, to complete the entire separation of the fibre and the seed, both chambers being provided with screens, substantially in the manner and for the purpose herein fully set forth and described."

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59. For an *Improvement in Warm Air Furnaces;* Alexander Kelsey, Assignor to James Cowles, Rochester, New York, April 27.

"The nature of my invention consists in the employment of an equalizing flanch, so arranged that the air which enters the furnace on both sides of a radiating cylinder is warmed to about the same temperature, before entering the warm air conducting flues."

Claim.—"Having thus described the nature of my invention, and the manner in which it is constructed, what I claim as new is, the use of an equalizing flanch, with the tubes attached, by which the air on each side of the radiating cylinder is warmed to about the same temperature before entering the warm air conducting flues."

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60. For an *Improvement in Machines for Pressing Tobacco;* Ephraim Parker, Rock Island, Illinois, Assignor to Alfred A. Parker, St. Louis, Missouri, April 27.

Claim.—"Having thus fully described the nature, construction, and operation of my improved tobacco press, what I claim therein as new is, the use of the revolving mould disk, combined with its revolving bed plate, with the scraper, and cloth roller, or their equivalents, for keeping the moulds free from the liquorice or juice of the tobacco, substantially as described.

"I also claim the use of revolving sinkers, constructed substantially as described, combined with the pan and cushion, or their equivalents, for keeping the same clean, and the

combination therewith of mechanism for moving the sinkers a quarter of a revolution at every eight, more or less, number of pressings, substantially as described.

"I also claim the conductor, formed of endless aprons or belts, or their equivalents, for confining and retaining the plugs under pressure, until they are thoroughly consolidated, in manner and for the purpose substantially set forth."

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61. For a *Stud Brace for Flues of Sheet Water Space Boilers;* Andrew Lamb and William A. Summers, County of Hants, England, April 27; patented in England, December 9, 1848.

Claim.—"What we claim as our invention is, the stud brace, for bracing the flat surfaces of steam boilers, substantially as described in the foregoing."

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62. For an *Improvement in Brushes;* Freeman Murrow, Williamsburgh, New York, April 27.

"Brushes constructed in the usual manner, with fixed and immovable handles, are inconvenient for many purposes for which they are needed; to remedy these defects, and to facilitate execution in the use of brushes, is the object of my invention; and it consists in so connecting the handle with the brush thereof, by means of a ball and socket, and sliding joints, that the brush can be adjusted to any desired position and angle with its handle."

Claim.—"Having thus fully described my invention for brushes for white-washing, varnishing, painting, washing painted cornice and walls, &c., &c., what I claim as my invention is, the double adjustability of the brush, by means of the combination of the ball and socket joint, and the sliding joint, or their equivalents, substantially as herein set forth."

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63. For an *Improved Float Gauge Feed Regulator, &c., for Steam Boilers, &c.;* Thomas J. Sloan, City of New York, April 27.

Claim.—"I do not wish to be understood limiting myself to the construction and arrangement of parts herein above described, as these may be varied, without changing the principle or mode of operation of my invention.

"I am aware that a float placed within a boiler, or within a vessel communicating with a boiler, has been employed to regulate the position of ratchet hands, operated by an independent mechanism, to open and close a valve cock, or regulate the motion of a pump, the said float being employed simply to engage or disengage the said ratchet hands; but when so employed, the said float has been so arranged as to act on the said mechanism outside the boiler, &c., and hence, subjected to the difficulties above pointed out.

"I do not therefore claim, broadly, the employment of a float to regulate the action of an independent mechanism, as a means of indicating the height of water. and regulating the supply thereof, when such float acts upon such mechanism outside of the boiler; but what I do claim as my invention is, the employment, substantially as described, of an independent float, within a steam or other boiler or vessel, which, as its position is varied by the change of level of the water, shall act as a check or stop to the motion of a mechanism combined therewith, and operated by an independent motive force outside of and passing through to the inside of the boiler, substantially as described, to determine the supply of water to be given, or to give the required indication or alarm, as specified.

"And I also claim the method herein described, of preventing the action of the mechanism outside, which is actuated by an independent force, from reacting on and changing the position of the float, that it (the float) may be free to follow the varying level of the water, as specified."

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64. For an *Improvement in a Self-Loading and Dumping Cart;* B. T. Stowell, Waddam's Grove, Illinois, April 27.

Claim.—"What I claim as my invention is, the manner of opening and closing the slatted bottom of the cart body, substantially as herein set forth, viz: by means of a bar, which is jointed to the rear edge of the foremost slat, and which, when its rear end is unfastened, descends vertically, and allows the whole series of slats to be opened simultaneously, by the action of the weight within the cart body pressing upon the same; and when the rear end of the said bar is drawn rearwards and upwards, simultaneously actuates the whole series of slats, and thereby closes the bottom of the cart body."

65. For an *Improved Steering Apparatus;* Alfred Swingle and Nehemiah Hunt, Boston, Massachusetts, April 27.

Claim.—"We are aware that the steering gear and rudder head have been connected together, and the tiller made to rise and fall with them; and therefore we do not claim such an arrangement: but what we do claim as our invention is, the construction and arrangement of the tiller and rudder head as described, in combination with steering gear, entirely separate from the rudder head; the tiller being connected with the latter and attached to the former in such manner, that when the rudder is unshipped, or raised unusually high, by striking the bottom, the tiller will be disconnected therefrom, without danger of breaking either the steering gear or the rudder head, or being itself broken."

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66. For an *Improvement in Boxes for Journals;* Henry Turner, Charlestown, New Hampshire, April 27.

Claim.—"I claim making the cap box in the manner described, that is to say, of alternate pieces of hard and soft metal, arranged in a helical position, by which, together with the circular end pieces, the soft metal is kept in place, and friction and injury to the axle prevented, substantially as described."

Re-issues for April, 1852.

1. For an *Improvement in the Construction of Furnaces for Smelting Iron Ore;* J. Augustus Roth, Philadelphia, Pennsylvania; patented October 31, 1839; re-issued April 6, 1852.

Claim.—"Having described the construction and operation of my improved furnace for smelting ores and metals, I will now state what I claim as my invention and improvement. 1st, I do not claim the increasing of the draft as separately by itself. 2d, And I do not claim to generate steam, or to heat the blast by waste heat, otherwise than hereafter claimed.

"I therefore only claim as my invention and improvement, the arrangement of the five chambers, opening each by a flue into one horizontal flue, in combination with the boiler placed in said flue for generating steam, and the pipes therein, as a means of heating the blast; the whole being constructed and operating as described."

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2. For an *Improvement in Washing Apparatus;* James T. King, Baltimore, Maryland; patented October 21, 1851; re-issued April 13, 1852.

Claim.—"Having thus fully described my invention, what I claim therein as new is, placing the rotary boiler for washing clothes immediately over the fire, and so combining with it a reservoir or top boiler, as that said rotary boiler shall form the lower half of the flue, whilst the said reservoir or boiler shall form the upper half of said flue, and from which the revolving boiler may be supplied with water, and thus greatly economize heat, substantially in the manner herein described and represented.

"I also claim, in combination with the rotary boiler and shielded stationary pipe, the top reservoir or boiler for receiving the excess of steam from the boiler, and heating the water therein; and this I claim, whether said reservoir is divided by partitions or not; the whole being arranged in the manner and for the purpose herein described."

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3. For an *Improvement in Self-Detaching Brakes;* John Lahaye, Reading, Pennsylvania; patented April 10, 1847; re-issued April 13, 1852.

Claim.—"What I claim as my invention, in combination with the method of forcing the brakes against the wheels, by connecting the brakes, or the mechanism which works them with the bumpers or draw-bars, substantially as specified, is, the method, substantially as specified, of releasing the brakes, notwithstanding the continuance of the forces by which they were applied, by the reversing action of the wheels on the brakes, to effect a disengagement of the pressing force, as described.

"As one of the devices for applying the principle of my invention, I also claim connecting, by means of a detachable catch or hook, substantially as specified, the bumper or draw-bar, with the lever, or its equivalent, which forces and holds the brake against the wheels, substantially as specified, so that, notwithstanding the continuance of the back-

ward pressure on the said bumper or draw-bar, the connexion can be readily broken, to relieve the brake, and thus leave the wheel free to run, as specified.

"And I also claim making that part of the brake which acts directly on the wheel, separate from, but so connected with, as to slide freely on the part which receives the action of the mechanism for forcing the brake against the wheel, substantially as described, by means of which, on reversing the motion of the wheel, the one part of the brake in contact therewith is made to slide, to give the required motion for effecting the disengagement, as above specified."

Designs for April, 1852.

1. For a *Design for Cooking Stoves;* Anthony J. Gallagher and John J. Baker, Philadelphia, Pennsylvania, April 20; ante dated January 7, 1852.

Claim is to the application of the above design to cooking stoves.

2. For a *Design for Cooking Stoves;* John J. Savage, Assignor to Alexander Morrison and Thomas M. Tibbitts, Troy, New York, April 13.

Claim is to the configuration of and ornamenting the plates and panels of cooking stoves, substantially the same as herein represented and set forth.

3. For a *Design for a Cooking Stove;* Samuel H. Sailor, Assignor to North, Harrison & Chase, Philadelphia, Pennsylvania, April 27.

Claim is to the design and configuration of the conical rods, series of converging angular rays, central figure, and leg, as herein described, forming an ornamental design for a cooking stove.

4. For a *Design for a Portable Furnace;* James G. Abbott and Archilus Lawrence, Philadelphia, Pennsylvania, April 27.

Claim is to the combination and arrangement of the ornaments herein represented and specified, making an ornamental design for a portable furnace.

MECHANICS, PHYSICS, AND CHEMISTRY.

Translated for the Journal of the Franklin Institute.

Summary of a Series of Meteorological Observations made on the Pyrenees, during the summers of 1848 *and* 1849; *on the Mountains of Provence, during the summer of* 1850; *and on the French Alps, during the summer of* 1851. *By* M. Rozet.

The aqueous vapors which emanate continually from the surface of the earth, rise in the atmosphere, without being visible, at least generally, to a height proportional to the temperature of each place. As the temperature falls in proportion as the height increases, these vapors finally come into a region where they are compelled to pass from the invisible to the visible condition. When the air is calm and the heavens serene, this region is marked by a light haze, like a gauze, terminated above by a horizontal surface. The observer sees this terminal surface perfectly when he stands at the same elevation with it, or a little above or below it. When he is at a certain height above it, he sees it forming around the horizon a narrow band constituting an immense ring, of which he occupies the centre.

It is on the level of this terminal surface of the ocean of vapors that the cumulus clouds generally originate. Limited by it below, they rise

above it to variable heights in mammillary masses, and terminate above in irregular curved surfaces. When these clouds do not touch each other, the interstices which separate them are seen at the level of their bases, occupied by a light fog which connects them together.

The height of the terminal surface of the ocean of vapors varies with the temperature; being at its minimum about sunrise, it attains its maximum about 2 o'clock afternoon, then sinks again until the next morning. The summits covered with snow determining around them a region colder than the zone of the atmosphere which is at their level, the portion of the terminal surface of the vapors which passes above them bends towards them, as the clouds on this surface come and attach themselves to the mountain. At the level of this surface I have always found the temperature above 0°. (32° Fahr.) In the Pyrenees, the maximum of altitude was 2200 metres, in the Alps I have known it to attain 3200 metres.

In the valleys, peculiar circumstances, such as the presence of snow, winds from the north sweeping their flanks, shadows thrown by high crests, &c., determine cold regions, in which the vapors coming from the soil are forced to pass into the visible state far below the level at which this happens for the country in general. Then there is seen to form in these regions a horizontal mist covering the valleys, and often afterwards strata of cumulus lower than the general mass, which at the same moment is higher than the summits of the mountains overlooking the flanks of the valleys.

In the Alps, the height of the upper surface of the cumulus often exceeds 4000 metres, (4376 yards,) of which I have been able to assure myself by referring it to the summit of Pelvou, which rises to 4100 metres (4485·4 yards) above the level of the sea. It is above this surface, and often at more than 2000 metres (2188 yards) above it, according to my estimation, that the region of the *cirrus* begins. These clouds, which the observation of halos and the aerostatic ascent of MM. Barral and Bixio (*Journ. Frank. Inst., Vol.* XXI. *3d series, p.* 34) have shewn to be composed of very small crystals of ice, must, from the aspect of their lower surfaces, which are arranged like that of the cumulus on an immense spherical vault, occupy a region terminated below by a horizontal surface.

In calm weather, these two strata of clouds of different nature exist together without mingling. All the clouds of each stratum are in the same electric state; they are seen to approach, even to touch each other, without giving rise to the slightest electrical discharge. But the strata themselves are generally in opposite electrical states; for when, in bad weather, the clouds of each meet each other, the approach and contact are marked by greater or smaller electrical discharges.

It is from the mingling of the clouds of these two strata that storms, rain, and snow result. Then the cirrus is seen to descend, and the cumulus to rise, stretching itself out into columns, and the contact is immediately announced by the formation of a *nimbus*, in the vicinity and in the midst of which the electric discharges are seen when they take place. Often in summer, in autumn, and almost always in winter, the nimbus forms without the least appearance of electric discharges. This proves that the electricity which is developed during storms is one of their results and not the cause.

I have seen in the high mountains, heavy bodies of cumulus, hiding the sun from the country below them, exist above for several days together without giving rise to the slightest storm, nor to the least rain. I have made the same remark as to the strata of cirrus, with this difference, that this kind of clouds, which have but little thickness and rarely touch each other, allow a part of the sun's rays to pass.

When the cirrus and cumulus exist simultaneously, without touching each other, neither storm nor rain is produced; it is only at the points where the junction takes place that these phenomena shew themselves. This is the precise reason why it does not always rain at the same time at all points covered by a stratum of cumulus.

This year, in the Alps, I have frequently had occasion to establish the fact that it always snows in the region in which the meeting of the cirrus and cumulus takes place. The elevation of this snowy region varies with the temperature of the air, or, what amounts to the same thing, with the height of the stratum of cumulus. I have established this fact by observation on high points, whose elevation I had geodetically determined, on which snow fell while it rained on the plains and in the valleys below. Having at the same time observed the thermometer, I found that this summer, in the High Alps, whilst it rained in the valleys, at a height of 800 metres, (875·2 yards,) the thermometer being at—

+5° Cent.,	it snowed	down to		900 metres,		984·60	yards.
7	"	"	"	1000	"	1094·00	"
8–9	"	"	"	1200	"	1312·80	"
10	"	"	"	1500	"	1641·00	"
12	"	"	"	1700	"	1859·80	"
14	"	"	"	2000	"	2188·00	"
16	"	"	"	3000	"	3282·00	"

Having been three times so situated that I could easily pass from the region of snow to that of rain, I found that the rain in large drops came from flakes of snow, while the rain in small drops, which is generally colder than the other, comes from small grains of snow. In the snowy *nimbus clouds*, the thermometer stood at +2° (35·6° Fah.) in those giving flakes, and at +1° or +1·5° (33·8° or 34·7° Fah.) in those having the snow in small grains.

During three months I made a series of barometric observations, for the purpose of learning how the mercurial column varies at the approach of bad weather, during, and after it, which series led me to the following results:

The mercury begins to fall when cirrus and cumulus shew themselves in the atmosphere at the same time; the fall is greatest at the time of the formation of the nimbus. When the rain lasts only a few hours, the barometer remains stationary, and immediately afterwards rises sensibly, at the same time that the nimbus rises, passing into cumulus. When the rain has lasted several days together, I have seen the barometer fall and rise several times, without being able to connect its movements with those which were then going on in the clouds.

When in high regions the cirrus approach the cumulus, bringing with them a very low temperature, the thermometer falls suddenly several degrees, and the cold which results is very sensible, although in the place where the meeting takes place, I have never seen the thermometer descend below 0° (32° Fah.) This is the explanation of the sudden cold

which storms and rain bring with them. All my observations taken together, go to prove that all the aqueous meteors of the atmosphere have for causes, solely, variations of temperature, and that the development of electricity which often accompanies them, is simply a result of the approach and meeting of clouds of different kinds.

A great number of hypotheses have been formed to explain the formation of rain and storms. Hutton said, "The rain results from the mixture of two masses of air saturated with moisture, but of unequal temperatures." I have, while on a mountain, caused a mass of vapor, obtained by throwing snow on burning charcoal, to pass through a cumulus whose temperature was below 5°, (41·9° Fah.,) and no precipitation resulted. The artificial vapor soon disappeared by mixing itself with the other, whose temperature it did not sensibly increase. On railroads during fogs, I have often had opportunities of seeing that the steam coming from the chimney of the locomotive disappeared in the midst of the fog without giving rise to the slightest rain.

It is not possible, moreover, to account for the formation of the rain, and the principal phenomena which accompany it, by the rising of the clouds into a region where low temperature would precipitate the vapor; in the high regions of the atmosphere the vapor is in a frozen condition; when the temperature of the region in which the cumulus are situated lowers, they immediately descend, without any precipitation, to a point at which the temperature of the air is high enough to allow them to exist tranquilly. This fact may be established by a single day's observations on high mountains. During four years of observations on high mountains, I have never seen true rain form except by the mingling of cirrus with cumulus, that is, of frozen with vesicular vapor.

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*Hollow Bricks.**

"There is nothing new under the sun," was the observation of Solomon. If you remember, it was stated that it was intended by the Bey to send over specimens of hollow bricks, at the present time in constant requisition in Tunis, for the Great Exhibition; but the interest of such a contribution was at the last moment accidentally overlooked.

In the Museum of the Bath Scientific Institution, specimens of hollow bricks used by the Romans, and dug up within a short distance of the spot where they are now deposited, may be seen by any party interested. They are double the size of those used by Messrs. Bazely & Co., and are cemented together by *genuine Roman cement.* And, no doubt, a machine like our modern ones for making them was also used by the Romans. It would be interesting to test the strength of these bricks, and of the cement that unites them, as compared with the modern manufacture. In Bengal, the floors of Bungalows are usually constructed with earthenware pots, commonly called "Kedgeree pots," turned over, with their orifices on the ground. Charcoal is filled between the interstices, and a coat of brick concrete is laid on the top, thus forming a perfectly dry floor. What a comfort would floors of hollow brick prove to the kitchens or cellars in some of our damp localities! H. W.

* From the London Builder, No. 469.

Extracts from the Engineer's Report to the Trustees of the Philadelphia Gas Works, in their 17th Annual Report, January, 1852.

The manufacturing department exhibits a moderate increase in the quantity of gas produced, and has fully maintained its usual character for purity and illuminating value. The gas made in the year is two hundred millions, eight hundred and forty-two thousand cubic feet, which added to the previous production, make the whole quantity yielded by the Works, eleven hundred and ninety-eight millions, seven hundred and one thousand cubic feet. The consumption of the different Districts is as follows:

To the District of Spring Garden, 7,039,800 cubic feet; to Southwark, 5,279,000 cubic feet; to Moyamensing, 1,254,700 cubic feet; and to the City proper, 181,638,825 cubic feet; leaving as the amount used in the Works and lost by leakage, 5,629,675 cubic feet, or rather more than $2\frac{1}{2}$ per cent. of the quantity made. This item has been somewhat increased this year by several incidents of unusual character. On two occasions mains in the street were broken by the caving of cellar vaults extending under the street, and the gas escaped in large quantity for several hours, before notice of the accident reached the Works. Another main was similarly fractured by the sinking of a culvert, and a considerable number of service pipes of the largest size was broken at the extensive fires in Chesnut street, at Sixth and Seventh streets, and continued to waste gas for several days before they could be reached through the burning ruins.

* * * * *

The varieties of coal used in any considerable quantity are those obtained from Pittsburg, Pa., Richmond, Va., English Newcastle, English Cannel, and a new article from New Brunswick, in British North America, which is used as a substitute for rosin when the coals are not rich enough in bitumen.

* * * * *

In accordance with the desire of the Committee on Police, the distribution has been so conducted as to place a pipe for the supply of public lamps in nearly every street, lane, and alley east of Schuylkill Third street; the few that remain unsupplied will be completed early in the spring, and a large proportion of those situated west of that line, will be similarly furnished in the course of this year.

The length of pipes thus laid is 42,141 lineal feet, chiefly of two, three, and four inch calibre, with a few six inch and eight inch, making with those previously laid, an aggregate length of 542,408 feet, or $102\frac{3}{4}$ miles.

The increase of services, meters, and burners within the City, is greater than in any previous year, nearly compensating for the withdrawal of the entire number in the District of Spring Garden, so that the number of lights supplied is but 1600 less than those in use a year ago, including those in that populous district.

The new meters and service pipes added are 1211, the whole number in use being 10,449.

The applications registered are 2529, removals and discontinuances

1339; the increase being 1190, with 21,616 additional lights, besides 124 new lamps in the streets.

The entire number of City customers on the books on the 31st of December, was 10,406, using 136,620 lights; the public lamps are 1588 in the streets, 50 in market houses, and 62 in public squares. The Districts of Southwark and Moyamensing report 4943 private and 178 public lights, making a total of 143,441 supplied by these Works.

* * * * *

The effect in economizing labor and materials is made very evident, by comparing the lime accounts of the last three years. Thus in 1849, 135,000,000 feet of gas required for purification 129,048 bushels of shell lime; in 1850, when the first series of enlarged purifiers was used, 182,000,000 feet were purified with 111,668 bushels, and in the past year, with two such enlarged series in operation, 200,000,000 feet have been purified with only 64,545 bushels. Should there be no very great increase of make of gas this year, it is probable that by the addition of the last and largest series, the quantity of lime may be reduced below 50,000 bushels.

Some experiments have also been made during the year, with a view to ascertain the value of several schemes for the manufacture and use of gas, that have recently claimed a share of public attention, both in this country and in Europe.

Among them are the so-called hydro-carbon gas, made from steam in combination with various hydro-carbonaceous materials, patented here and in England, by Mr. White; the gas from asphaltum or other highly bituminous substances recommended by Dr. Gessner; and the pure hydrogen light with platinum wick, put in operation by M. Gillard, in Paris. These schemes do not bear upon their face the evidence of absurdity or impracticability, such as attaches to the famous project of electric light at almost no cost, so much agitated a year or two back; but the results of our experiments are not such as to lead to the belief that any advantage would be derived, at present, by adopting them upon an extensive scale. The proper course with respect to them will be to keep them in view, by following up experimentally all their modifications and improvements, of which some that are of practical importance have already been suggested, so as to be prepared to substitute them for the present methods, as soon as such course may be rendered advantageous, either by the perfection of the new plans, or some commercial revolution affecting the value of the materials or products of the different processes of manufacture.

The only other experimental operations of the year of which mention need be made, were those connected with the ignition of the large body of Virginia coals already adverted to.

This ignition, which was undoubtedly of spontaneous origin, being for some time confined to the central and inaccessible parts of the mass, commenced early in the autumn, and spread very much through the interior of the heap before it became evident at the surface, by any other symptom than the peculiar benzoic odor that invariably accompanies this species of decomposition. As soon as the existence and locality of the ignition was discovered, attempts were made to check it, by the effusion of carbonic acid gas generated by the combustion of coke in an air-tight furnace, sup-

plied with air by means of a fan-blower. Large volumes of the gas were thrown upon the heap, and were also forced into the interior, through trunks and pipes of large calibre, the effect of which was to extinguish in a few moments every appearance of conflagration and active combustion, but it did not seem to influence materially the tendency to slow decomposition, by which great waste of the useful constituents of the coal is produced, and the fires rekindled on the withdrawal of the mephitic gas.

After repeated trials of this process, made through several weeks, it became evident that the entire destruction of the coals could be prevented only by their removal and speedy use, for which purpose the carbonic acid had to be discontinued, and the coals flooded with water.

Report on Analysis of Gas.

Philadelphia, January 6th, 1852.

John C. Cresson, Esq., Engineer, &c.

Sir:—We have the honor herewith to communicate the results of observations recently made by us at your request, upon the comparative illuminating powers of Gas used in New York and Philadelphia respectively.

The following table shows the observations actually made:

Date.	Denomination.	Pres're at Burner	Time.	Interval.	Meter Reading.	Quantity.	Cubic ft. per hour.	Mean cons'n pr hour.	Tests.	Photometric Distance. Gas burner.	Photometric Distance. Candle.
1852.		in.	h. m.	m	d.			c. f.			in.
Jan. 3.	Manhattan Gas.	0·4	2·12		20·0				No. 1	37·125	10
			·19	7	44·0	24·0	3·429		2	37·5625	"
			·32	13	90·5	46·5	3·577	3·5020	3	37·375	"
Exp. I.	Fish-tail Burner.		·37	5	108·0	17·5	3·500		4	37·5625	"
									White	37·9375	"
									" F.	38·	"
									Mean	37·59·375	"
Jan. 3.	Manhattan Gas.	0·2–0·25	2·43		8·5				No. 1	45·125	"
	Argand Burner.		·49	6	40·0	31·5	5·250		2	45·	"
Exp. II.	With conical deflector and swelled								3	44·875	"
									4	44·875	"
	glass chimney, 7·5 in. high.		·55	6	71·0	31·0	5·167	5·2080	White	44·625	"
									Mean	44·9	"
Jan. 5.	Philadelphia Gas.	0·4	11·18		25·9				No. 1	46·75	"
			·30	12	86·4	60·5	5·04 1-6		2	47·	"
Exp. III.	Fish-tail burner.		11·54		23·0			5·0375	3	46·625	"
			12·00	6	53·2	30·2	5·03 1-3		4	45·9375	"
									White	46·625	"
									Mean	46·5875	"
Jan. 6.	Philadelphia Gas.	0·225	0·11		18·5				No. 1	43·	"
			0·16	5	44·5	26·0	5·200		2	43·75	"
Exp. IV.	Argand Burner, as before.		·38		8·0			5·1600	3	42·875	"
			·43	5	33·6	25·6	5·120		4	42·75	"
									White	42·875	"
									Mean	43·05	"
Jan. 6.	Philadelphia Gas.	0·275	0·45		15·5				White	F. 47·625	"
	Argand Burner.		0·51	6	52·0	36·5		6·0830	"	A. 47·5	"
Exp. V.	Normal illumination.								Mean	47·5625	"

The observations in New York were made during day-time, but in a chamber utterly darkened; the tinting of whose walls and furniture was more favorable for experiment than was the case in Philadelphia.

The pressure-gauge was filled with Croton water in New York, and Schuylkill water in Philadelphia. As the absolute quantities consumed were otherwise directly ascertained, the record of the circumstance is of no further interest than as showing that the gases burned were of equal elasticities, respectively. The meter used was a small one, each of whose divisions corresponded with the $\frac{1}{60}$th of a cubic foot; the ratio of these divisions to minutes of time, is of course equivalent to that of cubic feet per hour, as given in the 8th and 9th columns. The readings of this in Philadelphia, were in fact made from minute to minute, at the beginning and end of each experiment, through the respective intervals. The grouping used in the table for convenience gives a mean result, very slightly differing (in the third decimal place) in excess from the average of the individual intervals.

The tests used were tissue papers of different colors as follows: Nos. 1 and 2 were different shades of red, or properly pink, No. 2 being the lighter; No. 3 was a light yellow or citron; No. 4 a sea green. The other was a white laid paper, of uniform texture and thickness.

The gas burners are indicated in the table. In New York, the pressure with the argand was all that could be obtained; the stop-cock being entirely open, and the burner doing its best. In Philadelphia, where a higher pressure was attainable, the stop-cock had to be more than one-third closed; and the burner was not giving its best flame. Therefore, the fifth experiment was made under circumstances differing as to pressure, but affording, as we consider, the properest practical comparison.

The candle was one of Judd's patent sperm. sixes. There was no opportunity for weighing the actual consumption of it in New York, and therefore it was not weighed in Philadelphia. The results, then, are still affected by a possible want of uniformity in this respect. Otherwise all pains were taken to keep its flame at a maximum state of illumination, with a wick of constant length, and with the same side turned always to the photometer.

This was of Ritchie's arrangement, where two glass mirrors, oppositely inclined at 45° to the horizon, reflect the light received at either end of the oblong chamber in which they lie, vertically upwards to a common orifice. We were reliably assured that the mirrors had been reversed, and no appreciable difference recognised between them. We did not, therefore, repeat the experiment by turning it end for end, but used it always in the same position, with the candle, as shown, at a constant distance from the apex of the mirrors; from which also the distance of the gas light was measured.

The numerical deductions from the observations are exhibited in the following table:

Actual Distances.		Ratio of Squares.					
Candle.	Gas Burner.	Candle	Number of Candles equal to 1 Gas light.	Consumption of Gas per hour.	Illuminative Power.	Ratio of Illumination.	Kinds of Gas and Burner.
in.	*in.*			c.f.			
10	37·59375	1 :	14·133 ÷	3·502 =	4·036	0·93	Exp. I. N. Y. Fish-tail.
10	44·9	1 :	20·160 ÷	5·208 =	3·871	0·89	" II. " Argand.
10	46·5875	1 :	21·704 ÷	5·0375 =	4·528	1·	" III. Phila. Fish-tail.
10	43·05	1 :	18·533 ÷	5·160 =	3·592	0·83	" IV. " Argand.
10	47·5625	1 :	22·622 ÷	6·083 =	3·719	0·86	" V. " do. No. 2.

These ratios of illuminative power may be combined in various ways for a conclusive result, according to whichever burner and state of pressure may be considered as the fairest practical index. If the fish-tail burner and the greatest density be so regarded, as we are inclined to do, then the Philadelphia gas is at least 7 per cent. more illuminative, with equal quantities in equal times, than the Manhattan.

The following statements show the other results, thus:

	Philad'a.		Manhattan, N. Y.	
Fish-tail burner,	1·	:	0·93	
Argand, equal pressure,	0·83	:	0·89	
	0·83	:	0·8277	:: 1 : ·9972

or New York Manhattan gas $\frac{1}{4}$ per cent. worse than Philadelphia.

Again,

	Philad'a.		Manhattan, N. Y.
Fish-tail burner,	1·	:	0·93
Argand burner, best flame,	0·86	:	0·89
	1·	:	0·9625

i. e. New York Manhattan gas $3\frac{3}{4}$ per cent. worse than Philadelphia.

Finally,

	Philad'a.		Manhattan, N. Y.
Fish-tail burner,	1·	:	0·93
Argand, average,	0·845	:	0·89
	1·	:	0·9795

i. e. New York Manhattan gas 2 per cent. worse than Philadelphia.

The diversity of these results serves to show, what was otherwise to have been expected, that any and every illuminating gas, according to its chemical constitution and the pressure under which it is stored and delivered, requires a burner of a particular form and size to develope its fullest efficiency; in other words, that every gas wants its own burner.

In the present instance, the fish-tail burner used seems to leave very little to be desired for the Philadelphia gas; and the numerical results would undoubtedly have been different, had the New York gas been tried with its best adapted burner: but this would have required a series of

observations and trials which we were not authorized in making; and, besides, the fish-tail and the argand seem to us to embrace the two limiting modes of burning between which the maximum effect must be found.

In this aspect the last result, which covers to all probable variations of management or mismanagement in the ordinary use of gas, appears to us worthy of undoubted acceptation.

J. H. Alexander,
John F. Frazer.

Report on the Analytical Investigation of the Illuminating Gases of New York and Philadelphia.

The New York gas was taken from the office of Messrs. Spies, Christ & Co., corner of Broad and Beaver streets, in glass tubes drawn out to fine points, in which it was sealed by the blow-pipe flame, after a sufficient amount of the gas had passed through to insure the total expulsion of atmospheric air. The Philadelphia gas was taken at the Laboratory in College Avenue, Tenth street, between Market and Chesnut streets. The results prove them both to have been free of atmospheric air.

The course of analysis pursued was that of Prof. Bunsen, a description of which will be found in the *Journal of the Franklin Institute* for 1849. The results are given in volumes as the determinations were made, the reductions being in every case to the usual standards of England and the United States, viz: to 32° Fahr. and 30″ Barom. The thermometer was an accurate one of German manufacture. The barometer was a French aneroid, which had been previously compared with an ordinary mercurial barometer, and which would indicate the ·01 inch.

The following are the results of the analysis of 100 volumes of the two gases:

		New York Gas.	Philadelphia Gas.
Olefiant Gas	CH,	8·32	6·38
Marsh Gas	CH^2,	32·92	54·84
Hydrogen	H,	24·04	26·27
Carbonic Oxide	CO,	11·60	4·42
Carbonic Acid	CO^2,	2·10	0·97
Oxygen	O,	0·19	0·04
Nitrogen	N,	20·83	7·08
		100·00	100·00

James C. Booth,
Prof. App. Chem. Univ. Pa.
William L. Faber,
Philad., Dec. 30, 1851. *Pract Chem. & Metallurgist.*

Analysis of Illuminating Gas, furnished for Consumption in New York and in Philadelphia, and Comparison of its probable Chemical Constitution in the two Cities respectively.

The sample of New York gas was collected at the New York Hotel in the forenoon of 2d January, 1852, by J. H. Alexander, and understood to be furnished there by the Manhattan Gas Company; the sample of Philadelphia gas is believed to have been gathered in the forenoon of 1st January, 1852, by Professor Booth, from a burner in his Laboratory.

Direct measurements, corrected for a uniform barometer-stand of 30 in. and constant temperature of 32° F., gave the following results:

		Manhattan Gas.	Philadelphia Gas.
Carbonic Acid	CO^2,	0·0222	0·0087
Hydro-Carbons,	CH?,	0·0928	0·0996
Olefiant Gas	C^2H^2,	0·0344	0·0204
Lt. Carburetted Hydrogen	CH^2,	0·7089	0·3227
Hydrogen	H,		0·4049
Nitrogen	N,	0·1231	0·1461
		0·9814	1·0024

Assuming a constitution in accordance with the formulæ given above, these results may be reduced for comparison as follows:

	Manhattan. Volume.	Manhattan. Weight.	Philadelphia. Volume.	Philadelphia. Weight.
CO^2,	0·0227 =	0·0777	0·0087 =	0·0306
CH,	0·0945 =	0·1044	0·0993 =	0·1129
C^2H^2,	0·0350 =	0·0774	0·0204 =	0·0464
CH^2,	0·3204 =	0·4035	0·3220 =	0·4172
H,	0·4020 =	0·0623	0·4039 =	0·0645
N,	0·1254 =	0·2747	0·1457 =	0·3284
	1·	1·	1·	1·
Corresponding spec. grav.,		0·444		0·432

The quantities inscribed as hydro-carbons were among the volumes absorbed by chlorine water in the dark; and no doubt appear slightly in excess from the vapor of naphtha accompanying the potassium used as one of the re-agents. The sample on hand was not sufficient to allow a repetition of the experiment by which this source of error might have been eliminated; but as both samples were purposely treated alike, it is fair to consider its influence as proportionate in the two cases, and as therefore not affecting the comparison here.

The smallness of the sample of Manhattan gas also gave no opportunity for separating the proportions of light carburetted hydrogen and pure hydrogen in that instance, as was done in the case of the Philadelphia gas. In the comparison, therefore, they are distinguished in the same ratio for the former as was found experimentally for the latter.

And the same obstacle prevented the experimental determination of specific gravities. The values given for this term above, are therefore only theoretical, and have been presented merely in illustration; though they may be presumed not to deviate materially from the fact.

Finally, if abstraction be made of the nitrogen and the carbonic acid, the former of which certainly and the latter probably contribute nothing to the illuminating power in combustion, the economical efficiency of the two samples may be compared in the ratio of their aggregated combustible elements, as under:

	Carbon.	Hydrogen.
Manhattan gas,	0·45845 = 1·	0·18915 = 1·
Philadelphia gas,	0·44944 = 0·98	0·19156 = 1·01

This last comparison shows the Manhattan gas to be richer in carbon by 2 per cent. and poorer in hydrogen by 1 per cent., under equal weights, than the Philadelphia gas; and implies besides, that under low pressures at the burner, the Manhattan gas should have the advantage in illuminating power, while under high pressures this advantage would be exhibited by the Philadelphia gas; and, finally, that within this range there is a point of pressure at which the illuminating power of the two gases, with the same burner, would be found exactly the same.

David Stewart,
J. H. Alexander.

Baltimore, February 16th, 1852.

Note.—A later analysis of the Philadelphia gas, made by Dr. Charles M. Wetherill in the month of February, gives the following result:

Olefiant gas and Hydro-carbon vapors,	8·936
Oxygen,	0·136
Hydrogen,	44·168
Light Carburetted Hydrogen,	41·620
Carbonic Oxide,	5·081
Carbonic Acid,	0·000
Nitrogen,	0·059
	100·000

*Potash Salts in Soot from Blast Iron Furnaces.**

At the Glasgow Philosophical Society, on Wednesday, Dr. Penny communicated his discovery of the presence of a considerable quantity of potash salts in the soot from blast iron furnaces. The soot experimented upon was obtained from the Coltness Iron Works, where it collects in the flues that lead the heated gases, and other products of combustion, from the top of the furnaces to the air heaters and steam boilers. Dr. Penny gave the particulars of a careful analysis of the soot, and exhibited specimens of the potash salt, which had been extracted in large quantities by Dr. Quinlan, of Hurlet. The salt has been pronounced by competent judges to be a good marketable article, consisting chiefly of carbonate and sulphate of potash, with a small admixture of soda salts. According to the results of experiments described by Dr. Penny, it appears that the soot will yield about 50 per cent. of this marketable salt, containing 43 per cent. of pure potash. It has been found that the amount of potash in soot procured from other iron works is subject to variation, arising, no doubt, from the use of different coals in the blast furnace. From the well known value of potash salts, there is every reason to expect that this discovery will prove of considerable importance to those who are interested in these commercial products, and also to ironmasters, who will be enabled to turn to account a substance which has not hitherto been applied to any practical use.

*From the London Mining Journal, No. 847.

For the Journal of the Franklin Institute.

Performance of the U. S. Screw Steamship "San Jacinto," from Norfolk, Va., to Cadiz, Spain, during the month of March, 1852. By Chief Engineer, B. F. Isherwood, U. S. Navy.

The readers of the Journal are already acquainted with the dimensions of the *San Jacinto*, and with the unusual proportions of her screw propeller, as well as with its results during the few trials which have been made, and which were made under very unfavorable circumstances. An account, therefore, of her further performance will be acceptable.

On the 3d of March, 1852, at 6 A. M., the *San Jacinto* left Norfolk, Va., for the Mediterranean, using steam when the wind was ahead, (about half the time,) up to March 8th, midnight, when the forward bell crank of the starboard engine broke in the neck of the spade handle. The time under steam up to this period was 60 hours; the screw performing under the unfavorable circumstances of head winds and sea, assisted, but in a very small degree, by the sails. The results tabulated from the steam log are as follows:

Date—March, 1852.	Number of hours.	Revolutions of screw and double strokes of engines per minute.	Steam pressure in boiler above atmosphere, in pounds pr. sq. in.	Vacuum in condenser per gauge in inches of mercury.	Throttle open.	Portion of stroke of piston, steam cut off at.	Speed of vessel per hour in knots of 6140 feet.	Cumberland bituminous coal consumed per hour in pounds.	Slip of the screw in per cents of its speed.	Wind, Sea, and Sail.
3,	18	25·2	11·7	$24\frac{1}{4}$	$\frac{5}{16}$	$\frac{1}{2}$	7·50	2146	28·34	Head wind; no sail set.
4,	18	25·4	12·0	$24\frac{1}{2}$	"	"	7·00	2266	33·64	Heavy head wind; no sail set.
"	4	25·4	12·0	$24\frac{1}{2}$	"	"	7·75	2266	26·53	Light head wind; fore and aft sail set.
5,	8	24·5	11·5	$23\frac{7}{8}$	"	"	8·00	2039	21·38	Strong wind and heavy sea forward the beam; fore and aft sail set, and close reefed foretopsail.
6,	4	25·0	12·0	$24\frac{1}{2}$	"	"	7·50	1874	27·76	Head wind; no sail set.
7,	9	25·0	11·7	23·4	"	"	6·75	2094	35·00	Strong wind and heavy sea ahead.
8,	8	24·5	11·8	23·6	"	"	9·50	2389	6·63	Strong wind and heavy sea abeam; ship rolling heavily; single reefed fore and main topsail set.
Means,		25·06	11·8	24	$\frac{5}{16}$	$\frac{1}{2}$	7·58	2177	27·17	Strong head wind and sea; small amount of sail braced on the wind, used for three-tenths of the time.

The *slips* in the above table are calculated for the mean ($42\frac{1}{2}$ feet) pitch of the screw; and it will be at once observed how greatly a small amount of sail, and that on the wind, diminished the slip, showing how much the head winds retarded the speed; for the diminution of slip was more owing to the shifting of the wind from ahead around to a point where the sharply braced sail would draw, than to the effect of that sail.

Another point that will attract attention is, the manner in which the steam was used. The boilers are braced to sustain a working pressure of 30 pounds per square inch, and the cut-off or expansion valve is Sickel's, momentarily adjustable. The most economical manner, therefore, of using the fuel, would have been to carry say 20 pounds of steam in boiler per square inch above atmosphere, cutting off at one-fourth the stroke from the commencement, with the throttle wide open. Instead of that, the steam was used of a pressure of 11·8 pounds only, cutting off at half stroke, being also wire-drawn at the cylinder by a throttle $\frac{5}{16}$ths open. There was likewise a wretched vacuum of only 24 inches of mercury, instead of 27 inches.

From indicator diagrams taken during the trial trip, it appears that closing the throttle to $\frac{4}{16}$ths, caused a difference of $5\frac{1}{2}$ pounds between the boiler pressure and cylinder initial pressure, the engines then making 31 double strokes of piston per minute. Applying the same deduction now, with the throttle $\frac{5}{16}$ths open, and the double strokes 25·06 per minute, the total initial cylinder pressure would be $(11{\cdot}8 - 5{\cdot}5 + 14{\cdot}7)$ 21 pounds, and the mean total pressure throughout the stroke, including effect of steam in nozzles and clearance, would be 18 pounds: allowing the mean back pressure in the cylinders to be 2 pounds greater than in the condensers, the mean effective pressure throughout the stroke would be 13·3 pounds per square inch. The horses power developed by the engine would therefore be

$$\frac{3067{\cdot}96 \times 13{\cdot}3 \times 208{\cdot}83 \times 2}{33000} = 514{\cdot}8.$$

If, however, by better management, the steam were properly used as above suggested, the result would be as follows: Suppose the boiler pressure to be 20 pounds per square inch, and the initial cylinder pressure 18·3 pounds, cut off at one-fourth stroke from commencement, the mean total pressure throughout the stroke, allowing for effect of steam in nozzles and clearance, would then be 20 pounds; and with a condenser vacuum of 27 inches, and a cylinder back pressure greater than this by 2 pounds, as before, the mean effective pressure throughout the stroke would be 16·8 pounds per square inch of piston; and as the double strokes of piston with the same load, are in the proportion of the square roots of the pressures on it, they would become $(\sqrt{13{\cdot}3} : \sqrt{16{\cdot}8} : 25{\cdot}06)$ 28·167; and the speed of the vessel being proportional to the double strokes of piston, would then become 8·52, instead of 7·58 knots.

The comparative quantities of fuel consumed in the two cases would be as follows: In the one case, cutting off at half stroke, there would be used per stroke, including amount in nozzles and clearance, 189·5 cubic feet of steam of the total pressure of 21 pounds, and making 25·06 double strokes per minute. In the second case, there would be used per stroke, including same amount in nozzles and clearance, 101·2 cubic feet of steam of the total pressure of 33 pounds, and making 28·167 double strokes of piston. Allowing the advantage of using steam under a higher temperature (growing from the facts that a less proportional amount of water is evaporated to produce it, and that the fuels required are in pro-

portion to the water evaporated only,) to be balanced by the greater loss in radiation, we have for the comparison,

$$21 \times 189{\cdot}5 \times 26{\cdot}060 = 103705{\cdot}77, \text{ or } 1{\cdot}120,$$
$$33 \times 101{\cdot}2 \times 28{\cdot}167 = 94065{\cdot}40, \text{ or } 1{\cdot}000,$$

and the consumption of fuel, which in the first case is 2177 pounds of coal per hour, would in the second case become $\left(\frac{2177}{1{\cdot}12}\right)$ 1944 lbs. per hour, or 20·8 tons per 24 hours, giving a speed at deep draft of $8\frac{1}{2}$ knots against a strong wind and sea.

Owing, however, to their complexity, and the faulty manner in which the engines were designed, it is not at all probable that they could withstand the pressure contemplated, and for which the boilers were intended and could be used. The engines were intended for 36 double strokes of piston per minute, to drive a screw of 37 feet mean pitch; but the Chief Engineer of the *San Jacinto*, (who designed the engines,) apparently convinced of their faulty and weak character, limited the double strokes of piston to 25, carrying low steam, and following far with it. The result is, a far inferior performance to what might have been obtained from the present screw, with strong and efficient engines of the present size.

It will, nevertheless, be satisfactory to compare the actual performance of the *San Jacinto* with the performance of the *Saranac*, (a sister vessel of the same size and built from the same lines,) under nearly the same circumstances. The following is all that is found recorded in the logs of her performance in heavy weather:

SARANAC.

Date.	Number of hours.	Double strokes of engines per minute.	Steam pressure in boiler above atmosphere, in pounds pr. sq. in.	Vacuum in condenser per gauge in inches of mercury.	Throttle open.	Portion of stroke of piston, steam cut off at.	Speed of vessel per hour in knots of $6082\frac{2}{3}$ feet.	Bituminous (Cumberland) coal consumed per hour, in pounds.	Wind, Sea, and Sail.
Jan. 29 to Feb. 1, 1851,	74	11·39	12·8	$26\frac{1}{2}$	$\frac{7}{16}$	0·4	7·410	2626	Moderate head wind; rolling sea; no sail.
Feb. 14 and 15, "	48	12·07	9·0	26	$\frac{9}{16}$	0·5	7·400	2611	Moderate head wind; rolling sea; no sail.
Jan. 29, "	14	11·40	13·5	26	$\frac{1}{2}$	0·4	7·500	1843	Strong wind abeam; chopping sea; sail set.
Feb. 12 and 13, "	36	11·43	8·0	26	$\frac{9}{16}$	0·5	5·725	2187	Strong wind ahead; heavy head sea; no sail.
June 6 and 7, 1850,	48	9·15	10·0	$26\frac{1}{2}$	$\frac{1}{4}$	0·4	5·390	1800	Strong wind ahead; heavy head sea; no sail.

It is necessary to remark here, that the knots of the *Saranac* are $6082\frac{2}{3}$ feet each, as commonly taken in the British and American Navies; while

the *San Jacinto's* log line was expressly graduated to 6140 feet, or a geographical mile.

General Performance of the Saranac.

From all the steam logs of this vessel at the Navy Department, it appears that the *Saranac* has steamed 978 hours, of which 256 hours were under sail and steam, or about one-fourth the time. Weather generally fine, with ordinary swell and winds.

Mean initial pressure of steam in cylinder (by indicator) above atmosphere per square inch, . . .	9·3 pounds.
Cutting off at, from commencement of the stroke, (·0444+)	4 feet.
Double strokes of piston per minute, . . .	$12\frac{1}{4}$
Consumption of Cumberland bituminous coal per hour,	2466 pounds.
Mean effective pressure on piston per square inch (by indicator),	16 "
Horses power developed by the engines, . .	604·6
Speed of the vessel per hour in knots of $6082\frac{2}{3}$ feet, . .	8·144.
" " " " 6140 " .	8·068.

Comparison of the Performance of the San Jacinto with that of the Saranac.

In this comparison, the results are taken to be in the proportion of the cubes of the speed, for the powers employed.

	Powers.	Speeds.	Results or Speeds cubed.
San Jacinto,	514·8 horses, or 1·0000	7·580 knots of 6140 ft.	435·5195, or 1·0000,
Saranac,	604·6 " 1·1744	8·068 " " "	515·1673, or 1·2058,

and $\frac{1 \cdot 2058}{1 \cdot 1744} = 1 \cdot 027$, showing the application of the power in the *Saranac* to be 2·7 per cent. better than in the *San Jacinto*. There must, however, be applied to this, a mental correction for the influence of the following facts: That the *San Jacinto's* performance was for very deep draft, and in heavy weather; while the *Saranac's* performance was for mean draft, (that is, with half coal out and other weights full,) and in fine weather. These corrections would make the performance of the *San Jacinto* considerably superior to that of the *Saranac*—a result which might have been expected in sea-going vessels, from a well proportioned screw of $14\frac{1}{2}$ feet diameter, making only 25 revolutions per minute, against a common paddle wheel $27\frac{1}{2}$ feet diameter.

The consumption of fuel was as follows:

San Jacinto, . . .	2177 pounds of coal per hour,	or 1·0000
Saranac, ...	2466 " " "	or 1·1328

or nearly in the proportion (1·0000 to 1·1744) of the powers. The boilers, coal, and manner of using the steam, being very similar, this correspondence between power and fuel might have been expected.

Performance of the San Jacinto under Sail alone.

From March 8th, midnight, to March 15th, 8 A. M., the ship was on her course under sail alone, dragging the screw, which being uncoupled, revolved by the reaction of the water. The force and direction of the wind is not given, nor the sail carried; but the mean speed for the whole of the seven days was 7 knots per hour.

Performance of the San Jacinto, with Crippled Machinery.

The air pump of the starboard engine having meanwhile been disconnected, and the exhaust pipe turned up through the hatch of the engine

room, so as to work that engine non-condensing, the engines were again started on the 15th March. The results tabulated from the steam log are as follows:

Date—March, 1852.	Number of hours.	Revolutions of screw and double strokes of piston per minute.	Steam pressure in boiler per square inch above atmosphere.	Vacuum in port condenser in inches of mercury.	Throttle open.	Portion of stroke of piston, steam cut off at.	Speed of vessel per hour in knots of 6140 feet.	Virginia bituminous coal consumed per hour.	Slip of the screw in per cents of its speed.	Wind, Sea, and Sail.
15	8	21·8	13·0	24·7	5-16	½	6·75	2594	25·45	Light breeze ahead; no sail.
21	9	20·7	12·7	25	5-16	"	4·75	2298	44·75	Strong head wind; no sail.
22	15	19·1	11·2	25¼	5-16	"	2·75	2739	65·33	Strong gale ahead; no sail.
23	8	21·7	13·0	24½	6-16	"	5·00	2863	44·52	Strong gale ahead; storm, mizzen, and foretopmast staysail set.
24	24	22·0	13·0	25	6-16	"	6·00	3106	34·33	Strong wind ahead; no sail.
25	10	22·0	12·5	24½	6-16	"	6·30	2866	31·05	Strong wind ahead; no sail.

On the 21st and 22d, about forty fathoms of the port main brace, and also a large hawser, got paid overboard, and coiled around the screw, greatly retarding the speed. After it was cleared, the speed of the vessel increased from 2·75 to 5 knots, under nearly equal circumstances of weather.

On the 25th, at 11 A. M., the *San Jacinto* went into Cadiz for repairs, which would not require more than 10 or 12 working days to perform. Coal is cheap at this port, being delivered alongside the ship at $4·25 per ton.

For a further appreciation of the performance of the screw of the *San Jacinto* in heavy head seas and winds, it may be compared with that of the *Glasgow*, one of the fastest and largest ocean merchant screw steamships. On the passage of this vessel from Glasgow to New York, she made from the 11th to the 19th February, 1852, both inclusive, against a heavy head sea and strong wind, no sail set, 6·157 geographical miles per hour. (Vide *Nautical Standard*, March 27, 1852.) Under the same circumstances, the *San Jacinto's* speed is seen to have been 7·58 geographical miles per hour.

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*Statistics of Gas Works in Great Britain.**

In the United Kingdom, says a contemporary, 855 cities and towns are supplied with gas. Twenty gas-works belong to municipal corporations, or commissioners, and thirty-three to private individuals. 151 companies possess Parliamentary powers, while 682 carry on their business without such powers. (?) The capital invested is 12,300,000*l.*, and the quantity of gas annually manufactured exceeds twelve thousand millions of cubic feet.

* From the London Builder, No. 468.

For the Journal of the Franklin Institute.

Performance at Sea of the U. S. Steamship Fulton. By Chief Engineer B. F. Isherwood, U. S. Navy.*

The following account of the steaming of the *Fulton* from St. Mary's, Florida, to Havanna, during the $3\frac{1}{2}$ days she was making the passage, will show the performance of the vessel at sea under the ordinary circumstances of wind and swell. The mean draft of water was slightly less than the draft with half coal out and all other weights full.

Average steam pressure in boiler per square inch above atmosphere,	28 pounds.
Initial " cylinder " "	26·3 "
Average vacuum in condenser, of mercury, . .	27 inches.
Steam cut off at, from commencement of stroke of piston,	3 feet.
Mean effective steam pressure per square inch of piston, calculated for 2 pounds greater back pressure than in the condenser, and including expansive effect of steam in nozzles, clearance, &c.,	25 pounds.
Bulk of steam comprised between cut-off valve and piston at one end of cylinder, ...	3·094 cubic feet.
Double strokes of piston per minute, ...	$19\frac{1}{2}$.
Horses power developed by the engine, . . .	599·5.
Soft anthracite consumed per hour, . . .	2200 pounds.
Speed of the vessel per hour in knots of 6140 feet, .	$10\frac{3}{4}$.

Evaporation by the Boilers.

The space displacement of the piston per stroke of 10 feet 4 inches, is 140·9 cubic feet, and for 3 feet of that stroke is 40·644 cubic feet, to which add the space comprised between cut-off valve and piston, 3·094 cubic feet, making a total of 43·738 cubic feet of steam of the total pressure of 41 pounds per square inch, used per stroke; which per hour would become $(43{\cdot}738\times19\frac{1}{2}\times2\times60)$ 10234·69 cubic feet: to this must be added the loss by *blowing off*, so as to maintain the density of the water in the boilers at $\frac{2}{32}$.

The temperature of steam of the above pressure is 270·6° F., taking the temperature of the hot well at 100° F., and the total heat of steam at 1202° F., (neglecting small corrections, which would be out of place applied to data taken from the ship's log,) the proportion of caloric expended on the water evaporated would be (1202°—100°) 1102°; and on the water blown out (270·6°—100°) 170·6°, which is 13·4 per cent. of the sum (1102°+170·6°=1272·6) of the two, leaving 86·6 per cent. as the amount utilized. Increasing the evaporation in this proportion, we obtain $\left(\frac{10234{\cdot}69\times100}{86{\cdot}6}\right)$ 11818·35 cubic feet of steam per hour. The relative volumes of this steam and the water from which it is generated are 664 and 1, which give for the water evaporated $\left(\frac{84504{\cdot}80}{664}\right)$ 177·99 cubic feet. Taking the weight of a cubic foot of sea water at 64·3 pounds, there would be evaporated per hour by 2200 pounds of soft anthracite, $(177{\cdot}99\times64{\cdot}3)$ 11444·757 pounds of sea water, or 5·202 pounds of water per pound of coal.

* See ante, pp. 195 and 122.

Slip of the Paddle Wheels.

The circumference of the centre of effort of the paddle wheels is 72·26 feet; consequently,

$72{\cdot}26 \times 19\frac{1}{2} \times 60 = 84544{\cdot}20$ feet = speed centre effort paddles per hour.
$10\frac{3}{4} \times 6140 \qquad = 66005{\cdot}00$ feet = speed of vessel per hour.

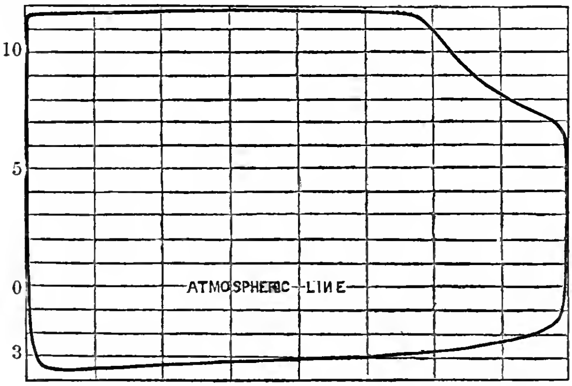
18539·20 feet = slip centre effort paddles per hour, or 21.93 per cent.

Indicator Diagrams.

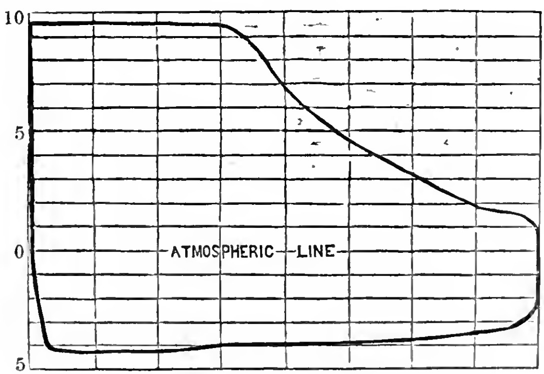
The indicator diagrams are added to show the action of the valves and the manner of using steam. The cut-off is Sickels', and momentarily adjustable. Under ordinary steaming at sea, the blowers are only used occasionally, when cleaning fires, pumping up, &c.

The indicator diagrams were taken in New York Bay, with the vessel deep laden, ready for a cruise.

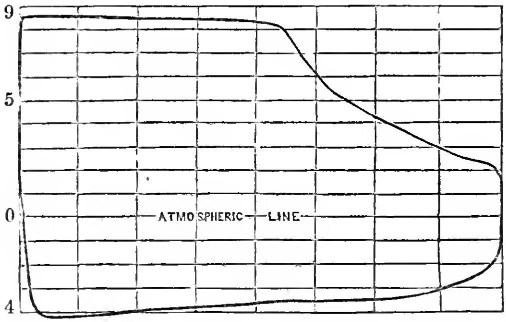
No. 1. Initial steam pressure in cylinder per square inch of piston above atmosphere, 35 pounds; cut off at three-fourths stroke of piston. Mean effective pressure throughout stroke of piston, $41\frac{1}{2}$ pounds. Double strokes of piston, 23 per minute.



No. 2. Initial steam pressure in cylinder per square inch of piston above atmosphere, 29 pounds; cut off at full three-eighths stroke of piston. Mean effective pressure throughout stroke of piston, $30\frac{1}{2}$ pounds. Double strokes of piston, 20 per minute.



No. 3. Initial steam pressure in cylinder per square inch of piston above atmosphere, $25\frac{1}{2}$ pounds; cut off at $\frac{9}{10}$ths stroke of piston. Mean effective pressure throughout stroke of piston, $30\frac{1}{2}$ pounds. Double strokes of piston, 20 per minute.



It will be observed, that the double strokes of piston were nearly in the proportion of the square roots of the effective pressure on it.

The square root of $41\frac{1}{2}$ is 6·442; of $30\frac{1}{2}$ it is 5·523; or the two are in the proportion of 1·166 to 1·000.

The double strokes of piston, 23 and 20, are in the proportion of 1·150 to 1·000.

For the Journal of the Franklin Institute.

U. S. Screw Steam Tug "John Hancock." By Chief Engineer B. F. Isherwood, U. S. Navy. (*With a Plate.*)

The *John Hancock* was constructed in 1850, to answer the double purpose of a steam tug and water tank for the U. S. Navy Yard at Charlestown, Mass., where she has since been stationed, with the exception of a short cruise to the Gulf of Mexico, during the *fillibuster* excitement of the Lopez expedition. On that occasion she was brig rigged, and carried a battery. The results hereinafter given are the mean of her performance at sea, without sail, under ordinary circumstances of weather.

The hull was built at the Charlestown Navy Yard. The machinery was constructed at the Washington Navy Yard, by Mr. Ellis, from the designs of Mr. Charles W. Copeland.

Hull.—Length between perpendiculars,		113 feet.
Beam, extreme,		22 "
Depth of hold,		9 "
Burthen,		208 tons.
Draft of water with half coal in, and all other weights full,	forward,	6 feet.
	mean,	$8\frac{1}{4}$ "
	aft,	$10\frac{1}{2}$ "
Immersed amidship section at the mean draft of $8\frac{1}{4}$ square feet,		154 square feet.
Square feet of immersed amidship section per cubic foot of space displacement of piston, multiplied by number of double strokes of piston per minute,		0·036.
Square feet of immersed amidship section per cubic foot of space displacement of piston,		2·017.

ENGINES.—Two oscillating non-condensing engines.

Diameter of cylinders,	1 foot 8 inches.
Stroke of piston,	1 " 9 "
Space displacement of both pistons per stroke,	7·636 cubic feet.
Mean effective steam pressure per square inch of piston,	25 pounds.
Double strokes of piston per minute,	55½.
Actual horses power developed by the engines,	79·25.

The mean effective pressure is calculated for an initial cylinder pressure of 1·7 pounds less than the boiler pressure, and for a back pressure of 2 pounds greater than the atmosphere, cutting off at three-fourths the stroke from the commencement, and allowing for the effect produced by 0·332 cubic feet of space comprised between the steam valve and piston.

Total weight of engines, including propeller shaft cased in brass, 38,955 pounds.

SUBMERGED PROPELLER (Plate VI.).—One of bronze, twist-bladed, but *not* a true screw, placed in the stern of the vessel, and connected directly to the engines.

Diameter.	8 feet.
Length of periphery in direction of axis,	3 "
Pitch at periphery,	18·040 feet.
Pitch at hub,	6·310 "
Diameter of hub,	1·250 "
Mean pitch in function of total helicoidal surface,	15·265 "
Mean pitch of the surface comprised between a diameter of 4 feet and the periphery, which may be considered as the *effective* propelling surface, and from which the slip is calculated,	16·739 "
Angle of periphery from a line at right angles to axis,	35° 40′.
Angle at hub from a line at right angles to axis,	58° 7′.
Number of blades,	3.
Total helicoidal area of blades,	44·135 square feet.
Total projected area of blades on a plane at right angles to axis,	30·333 "
Effective helicoidal area (between diameter of 4 feet and periphery),	32·856 "
Effective projected area, " " "	24·488 "
Proportion of the total helicoidal area of the propeller to immersed amidship section of hull.	1·000 to 3·489.
Proportion of the total projected area of the propeller to immersed amidship section of hull,	1·000 to 5·077.
Weight of the propeller,	2830 pounds.
Cost of the propeller,	25 cents per lb.

The following table will show the angles, corresponding pitches, &c., of the helicoidal surface of the propeller at various points from hub to periphery. The calculations are made by supposing that surface to be divided into a number (7) of parallel bands or strips, called elements, which appear as concentric circles when the propeller is viewed as a disk. The *angles* and *pitches* are those normal to the centre lines of the elements. The *pitches* are calculated as the heights of a series of right angled triangles, of which the bases are the circumferences normal to the radii of the several elements, and the angles given made with the circumferences by the hypotheneuses. Were one convolution of the thread used, the whole pitch would be employed, but as less than a convolution is used, only a *fraction of the pitch* is used, and this fraction varies for the different elements according to the length of the propeller at those elements in the direction of the axis. The *total lengths of the elements* are the hypotheneuses of a series of right angled triangles, whose bases are the circumferences, and whose heights are the pitches normal to those elements.

The *length of element used* is the total length multiplied by the corresponding fraction of the pitch.

Radii of elements.	Circumferences normal to radii of elements.	Angles of elements from a line at right angles to axis.		Pitches of elements.	Lengths of elements.	Fractions of pitches used.	Lengths of elem'ts used.	Breadths of elem'ts.	Areas of elements.
A	B $2A \times 3{\cdot}1416$	H		C $\frac{B \times \text{sine } H}{\text{sine supplement } H}$	D $\sqrt{B^2+C^2}$	E	F $D \times E$	G	$F \times G$
feet.	feet.	°	′	feet.	feet.	pr. ct.	feet.	feet.	sq. feet.
0·812	5·105	55	33	7·443	9·025	0·600	5·4150	0·375	2·0310
1·250	7·854	52	31	10·242	12·907	0·611	7·8862	0·500	3·9431
1·750	10·995	49	29	12·864	16·122	0·627	10·6101	0·500	5·3051
2·250	14·137	46	27	14·872	20·526	0·700	14·3682	0·500	7·1841
2·750	17·278	43	24	16·431	23·780	0·700	16·6460	0·500	8·3230
3·250	20·420	40	22	17·357	26·800	0·661	17·7148	0·500	8·8574
3·750	23·562	37	20	17·978	29·638	0·573	16·9826	0·500	8·4913
				Helicoidal area of propeller, . .					44·1350

Boiler (Plate vi.).—One iron boiler, with single return ascending flues.

Length of boiler, ... 22 feet.
Breadth, " . . . . 6 " 3 inches.
Height, " . . . . 7 " 5 "
Contents of circumscribing parallelopipedom, . . 1019·84 cubic feet.
Area of heating surface, ... 755 square "
Area of grate surface, ... 28 " "
Capacity of steam room in boiler, ... 200 cubic "
" " boiler, steam pipes, &c., . . 205 " "
Cross area of the two lower rows of flues, . . . 4·636 square "
" upper row of flues, ... 4·276 " "
" smoke chimney, ... 4·909 " "
Height of smoke chimney above grate, ... 37 feet 9 inches.
Mean pressure of steam above atmosphere per sq. inch in boiler, 31 pounds.
" " " " cylinder, 28·3 "
Cutting off at, from commencement of stroke, ($\frac{3}{4}$ths stroke,) 15$\frac{3}{4}$ inches.
Space comprised between cut-off valve & piston, (both cylinders,) 0·664 cubic feet.
Double strokes of piston per minute, ... 55$\frac{1}{2}$.
Consumption of bituminous (Cumberland) coal per hour, with natural draft, ... 598 pounds.
Weight of sea water in boiler, ... 22,700 "
" boiler and smoke chimney, ... 26,667 "
" boiler grate bars, ... 2260 "

Proportions.—Proportion of heating to grate surface, . 26·964 to 1·000.

Proportion of grate surface to cross area of the two lower rows of flues, 6·040 "
" " " upper row " 6·548 "
" " " of smoke chimney, 5·704 "
" heating surface to cross area of the two lower rows of flues, 162·856 "
" " " upper row " 176·567 "
" " of smoke chimney, 153·800 "

Square feet of heating surface per cubic foot of space displacement of piston,	13·356.	
" " " of space displacement of piston, per double stroke of piston per minute,	0·241.	
Square feet of grate surface per cubic foot of space displacement of piston,	3·667.	
" " " " " per double stroke of piston per minute,	0·066.	
Cubic feet of steam room to cubic foot of steam used per stroke,	25·309.	
Consumption of bituminous coal with natural draft per square foot of grate surface per hour, . . .	21·360	pounds.
Sea water evaporated from temperature of 212° F. by one pound of bituminous coal per hour, ...	7·651	"
Sea water evaporated from temperature of 100° F. by one pound of bituminous coal per hour, ...	6·938	"
Sea water evaporated from temperature of 212° F. by one square foot of heating surface per hour, ...	6·061	"

Total cost of boiler and smoke pipe, (26,667 pounds,) $2428·13, or 9·1 cents per lb.

The evaporation is calculated for an initial cylinder pressure of 1·7 pounds less than the boiler pressure; the feed water was by means of a heater furnished to the boiler at a temperature of 212° F.; the point of cutting off was at three-fourths the stroke from the commencement. Three-fourths the space displacement (7·636 cubic feet) of both pistons is 5·727 cubic feet, to which add the spaces comprised between the cut-off valve and piston, 0·664 cubic feet, at one end of each cylinder, and there results (5·727+0·664) 6·391 cubic feet of steam of 43 pounds per square inch total pressure used per stroke; the number of double strokes per minute being $55\frac{1}{2}$, there would be used per hour ($6·391 \times 55\frac{1}{2} \times 2 \times 60$) 42564·06 cubic feet. The relative volumes of steam of 43 pounds per square inch pressure, and the water from which it is generated, is as 635 to 1. The water evaporated would then be (42564·06÷635) 67·03 cubic feet, which, taking the cubic foot of sea water at 64·3 pounds, would be 4310·029 pounds. To this must be added the loss by blowing off at $\frac{2}{32}$. Taking the total heat of steam at 1202° F., and the temperature of the feed water at 212° F., there would be supplied to the feed water by the fuel 990° F. of heat. The temperature of the steam is 273° F.; the difference between the temperature of the feed water and the water blown out is (273° — 212°) 61° F., and as equal quantities of the water pumped into the boiler are evaporated and blown out, the proportion of the heat expended in evaporating will be 990°, and in blowing out 61° F. The total heat furnished by the fuel will be then (990°+61°) 1051°, and of this, 61°, or 5·8 per cent., is lost, leaving (100· — 5·8) 94·2 per cent. utilized, and if 94·2 per cent. evaporates 4310·029 pounds, 100 per cent. will evaporate 4575·4 pounds. The amount of fuel consumed per hour was 598 pounds; consequently one pound of fuel evaporated (4575·4÷598) 7·651 pounds of sea water from a temperature of 212° F.

To obtain the evaporation from a temperature of 100° F., in order to compare it with the results from the boilers of condensing engines, where the feed water is supplied of that temperature, it is necessary to consider that the latent heat of steam is 990°, which increased by 212°, (the temperature of the feed water for which the evaporation has been obtained,) amounts to 1202°; also, the same latent heat (990°) increased by 100°, (the temperature of the feed water for which the evaporation is to be

obtained,) amounts to 1090°. Hence the proportion in the first case between the latent and the sum of the latent and sensible heats is as

$$990 : 1202, \text{ or as } 1{\cdot}0000 : 1{\cdot}2142,$$

and in the second case it is as

$$990 : 1090, \text{ or as } 1{\cdot}0000 : 1{\cdot}1010,$$

and as the proportion of 1·2142 to 1·0000 gave 7·651 pounds, the proportion of 1·1010 to 1·0000 will give 6·938 pounds.

The ashes, clinker, and refuse of the coal from the furnaces amounted to 12·8 per cent. of the total weight of the coal put into the furnaces.

Performance.—Of the entire time of steaming, during one-half there was a light fair wind, and the remaining half a light breeze ahead. Ordinary sea, and no sail set. Speed of the vessel, 6·411 knots of $6082\frac{2}{3}$ feet per hour. Steam pressure in boiler above atmosphere per square inch, 31 pounds, cutting off at three-fourths the stroke from the commencement. Consumption of best Cumberland (bituminous) coal, 598 pounds per hour. Revolutions of the propeller, and double strokes of engines, $55\frac{1}{2}$ per minute.

Slip of the Propeller.—Taking the pitch of the propeller at 16·739 feet, the slip would be as follows:

$16{\cdot}739 \times 55\frac{1}{2} \times 60 = 55740{\cdot}870$ feet = speed of propeller per hour.
$6{\cdot}411 \times 6082\frac{2}{3} = 38995{\cdot}976$ " = " vessel "

16744·894 " = slip of propeller " or 30·04 per cent.

Comparison of the "John Hancock" with the U. S. Paddle Wheel Steamer "Spitfire."

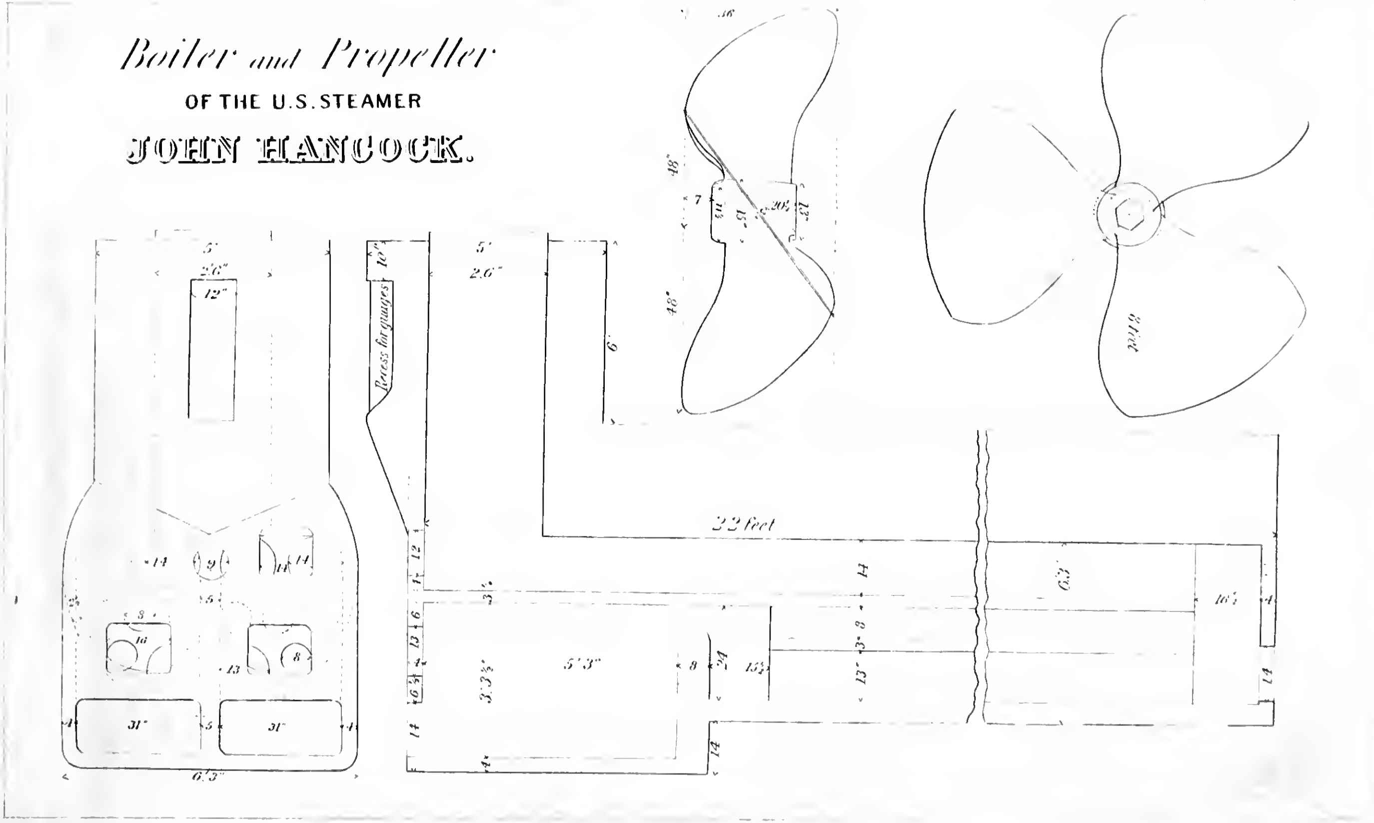
Being in possession of the log of the *Spitfire*, (a small war steamer, with a condensing engine, and having about the same resistance of hull as the *John Hancock*,) giving her mean performance at sea, a comparison of the relative efficiency of the two modes of propulsion can be made under the circumstances in which they were intended to be employed, viz: at sea, and loaded and trimmed as war steamers.

		John Hancock.	Spitfire.
Hull.	Length between perpendiculars,	113 feet.	...
	Length on deck,	...	118 feet.
	Extreme beam on deck	22 "	$22\frac{1}{2}$ "
	Depth of hold,	9 "	11 "
	Mean draft of water,	$8\frac{1}{4}$ "	$7\frac{1}{3}$ "
	Area of immersed amidship section at mean draft,	154 square feet.	154 sq. feet.
	Horses power developed by the engines,	79·250	89·936
	Speed of vessel in knots of $6082\frac{2}{3}$ feet per hour,	6·411	6·390
	Slip of propelling instrument,	30·04 per cent.	13·34 pr. ct.

Considering the cubes of the speeds as the measures of the resistances, we have a resistance of ($6{\cdot}411^3$) 263·498 overcome by a power of 79·250, in the case of the *John Hancock*, and a resistance of ($6{\cdot}39^3$) 260·917, overcome by a power of 89·936 in the case of the *Spitfire;* and

$$\frac{263{\cdot}498}{79{\cdot}250} = 3{\cdot}325 \text{ and } \frac{260{\cdot}917}{89{\cdot}936} = 2{\cdot}901;$$

Boiler and Propeller
OF THE U.S. STEAMER
JOHN HANCOCK.



consequently the application of the power was better in the *John Hancock* than in the *Spitfire* in the proportion of 3·325 to 2·901, or as 1·0000 to 0·8725, supposing the two vessels to offer equal resistance to the power.

It will be observed that there was a great inequality in the slips of the propelling instruments of the two vessels, that of the *John Hancock* being 30·04 per cent., while that of the *Spitfire* was 13·34 per cent., a difference of 16·70 per cent. The loss by oblique action with the paddle wheel of the *Spitfire* was 18·50 per cent., making the sum of the losses by the paddle wheel (13·34+18·50) 31·84 per cent.

The powers (79·250 and 89·936 horses) exerted in the two vessels were the gross powers developed by the engine. A more accurate idea of the relative efficiency of the propelling instruments will be obtained by reducing these powers to the portions applied to the propelling instruments. The consideration of the friction of the load can be omitted, as it would be proportional to the load.

Beginning with the *Spitfire*, it may be taken that the power required to overcome the friction of the engine alone is 1 pound per square inch of piston, and the power required to work the air pump is 0·7 pound per square inch of steam piston. The mean effective pressure per square inch of piston was 18 pounds. The per centage of power, therefore, lost in working engine and air pump would be $\left(\frac{1 \cdot 7 \times 100}{18}\right)$ 9·444 per cent., and 9·444 per cent. of 89·936 is 8·494, leaving 81·442 horses.

The engines of the *John Hancock* being non-condensing, their gross power will only have to be reduced by the 1 pound per square inch of piston required to work them. Their mean effective pressure per square inch of piston being 25 pounds, 1 pound would be 4 per cent., and 79·25 diminished 4 per cent. is 76·08 horses.

The comparison of powers with effects or resistances overcome by powers applied to propelling instruments will be as—

$$\frac{263 \cdot 498}{76 \cdot 08} = 3 \cdot 4634, \qquad \text{and } \frac{260 \cdot 917}{81 \cdot 442} = 3 \cdot 2037;$$

consequently the propeller of the *John Hancock* was more efficient, economically, than the paddle wheel of the *Spitfire*, in the proportion of 3·4634 to 3·2037, or as 1·000 to 0·925.

As the data used in these latter calculations, both of power and resistance, are only general practical averages, and not critically accurate for the particular cases, the results cannot be depended on within a few per cents; consequently we are only entitled to conclude that the two propelling instruments were equally efficacious.

Cost and Weight of Machinery.—The neat cost of propeller, engines, and boiler was $7562·35, in which is included 10,000 pounds of brass castings. Cost of patterns, additional, $487·47. The total weight of propeller, engines, and boiler, exclusive of water, is 70,712 pounds. The engine frames were of wrought iron, with finished columns.

On the Electro-Magnetic Motor of Fessel. By M. Plucker.*

It is known that Mr. Page, a physicist in North America, has recently endeavored to produce a motive power by an extended application of the force which attracts a mass of iron within an electro-magnetic helix. Th. Hankel, of Leipzic, has made the same attempt, and has established an important practical law, namely, that this force is as the square of the power of the current. M. Fessel has on his part constructed a model of a machine at my request, the value of which I am not for the moment able to appreciate in case it were made on a large scale, but which as a piece of physical apparatus explains and clears up the application of the force in question.

The model of Fessel is formed of two helices placed end to end in a horizontal position. They serve to conduct the current always in the same direction, but in such a way that it traverses alternately each of the two helices, and consequently only one at a time. In the interior of the helices is a bar of iron, which is alternately attracted from the one into the other by constantly maintaining the same polarity, and which thus executes a motion backwards and forwards. To the two extremities of the bar are fixed two slender horizontal shanks of brass, which rest upon two pullies attached to the two extremities of the apparatus, and which thus support the whole weight of iron. One of these shanks sets a wheel in motion. A commutator is moved by an eccentric by means of a directing-rod, which is placed so as to be able to make the machine move backwards and forwards as in steam-vessels. In one of the machines the commutator has been fixed immediately to the axis.

Two couples of Grove's cells are sufficient to communicate to this apparatus a great rapidity. With six couples, the rapidity became such that it threatened to break the apparatus; and fearing this, I stopped the passage of the current.

I have just received from him the news that he has nearly completed the construction of a new apparatus, in which he has replaced the pulleys by oscillating shanks of metal rod, similar to the oscillating cylinders of the steam engines.—*Bibliothèque Universelle de Genève, December*, 1851.

For the Journal of the Franklin Institute.

Explosion of the Steamboat "Pocahontas." By A. C. Jones, Engineer.

To the Committee on Publications.

On February 18, 1852, the steamboat *Pocahontas*, in backing out from a wood yard on the Arkansas river, collapsed both flues of the middle boiler, scalding eighteen persons, of whom eight died within a few hours after. The three boilers are two years old, $28\frac{1}{2}$ feet long, 38 inches in diameter, with 14-inch flues. By inspection, I found that half of each flue is torn from the after head; one flue is flattened vertically, and the other one horizontally; the end sheet of one is much laminated, and has been burned in turning the flanch on it. The iron is scant one-quarter inch thick;—this is entirely too light, particularly if they carried the steam

* From the Lond., Edinb., and Dublin Philosoph. Magazine, February 1852.

to the extreme of the pressure gauge, (200 lbs.) The time elapsed has obliterated the marks of the water line—the flues appear as if they had been partially overheated. The position of the gauge cocks in the outside boilers show that these were worked on the scant water system. The middle boiler has *no gauge cocks in it*, and yet the inspector's certificate, dated New Orleans, January 24, 1852, pronounces them in good order! The shell is uninjured, and no other damage was done to the boat.

For the Journal of the Franklin Institute.

Notes on the Steamship "State of Georgia." By J. V. Merrick, Esq.

(*With a Plate.*)

This steamer, before noticed in this *Journal*, has recently been completed, and will leave this port as pioneer of the line to Savannah, Geo., on the 12th of May. Her engineer's trial trip was made on the 27th and 28th April, 1852, and an account of her performance, with the principal dimensions, &c., will doubtless be interesting to many readers.

Hull constructed by Vaughan & Lynn, Kensington.

Length on deck,	210 feet.
" between perpendiculars,	200 "
Breadth,	33 "
" over guards, (extreme,)	56 " 10 inches.
Depth of hold,	21 "
Depth of lower hold,	13 "

Rigged with three masts; three square sails on foremast; fore and aft sails on main and mizzen mast.

Draft, loaded, estimated at 12 ft. 6 in., to 12 ft. 9 in., which is about 6 inches more than was intended, owing to the unusual size and weight of timbering.

Machinery constructed by Merrick & Son, Southwark.

Space occupied in lower hold, by machinery and full complement of coal (155 tons,) is 54 feet 9 inches long, and whole width of ship as follows:—

Engine space, 13½ feet wide, with bunks on each side,	30 feet 9 in.
Fire room,	8 " 3 "
Boilers,	14 "
Passage forward of boilers,	1 " 9 "
Total,	54 " 9 "

Between decks, space 12 feet 3 inches wide, and 46 feet long; centre of shaft, 80 feet forward of stern post.

Engine, single side lever, with condenser below cylinder; air pump on same end, and outside steam chests having balance valves.

Cylinder,	72⅝ in. diam. 8 ft. stroke.
Nominal horse power,	220·6
Air pump,	46½ in. dia., 37 in. stroke.
Lead on steam valves (lift,)	¼ inch.
Lead on exhaust valves (lift,)	13-16 inch.

Is fitted with H. Allen's momentarily adjustable cut-off arrangement.

Paddle Wheels, ordinary radial, with single floats.

Diameter over floats,		29 feet 4 inches.
Width of "		9 " 3 "
Depth of "		1 " 10 "
Number of "	28	
Mean dip on trial,		4 " 4½ "

BOILERS (Plate VII.); two return tubular, natural draft; dimensions of each:

Length,	14 feet.	
Width,	12 "	
Height,	10 "	10 inches.

240 tubes of 3 inches inside diameter; 9 feet 6 inches long.

4 furnaces with brick bridge walls.

Heating surface, (to 12 inches above tubes.)

4 Furnaces and back connexions,	452	square feet.
Tubes,	1774	"
Front connexion,	76	"
Total in each,	2302	"
" both,	4604	"
Grate surface, " "	145	"
Cubical contents, (without drums,) " "	2077	cubic feet.
Water space, (to 12 inches above tubes,) "	1374·4	"
Steam space, including drums, "	1017	"
Weight of each boiler,	38,600	pounds.
" water in each boiler,	43,980	"
" each boiler filled,	82,580	"

or, $73\frac{3}{4}$ tons total for both.

SMOKE STACK.—

Diameter,	5 feet 9 inches.		
Total height above bars,	60 feet, as follows:		
From bars to centre of tubes,	3 feet	9 inches.	
" centre of tubes to top of drum,	15 "	3 "	
" top of drum up,	41 "		
	60 "	0 "	

PROPORTIONS.—

Heating surface to cubic foot of cylinder,	20·40 to 1·00
" " grate surface,	31·75 " 1·00
" " pounds fuel per hour,	2·39 " 1·00
" " nominal horse power,	20·93 " 1·00
Grate surface to area over bridge,	1· " 0·127
" " area in tubes,	1· " 0·163
" " " chimney,	1· " 0·180
Steam space to cubic foot of cylinder,	4·5 " 1·00

PERFORMANCE.—Trial Trip made down the Delaware river and out to sea.

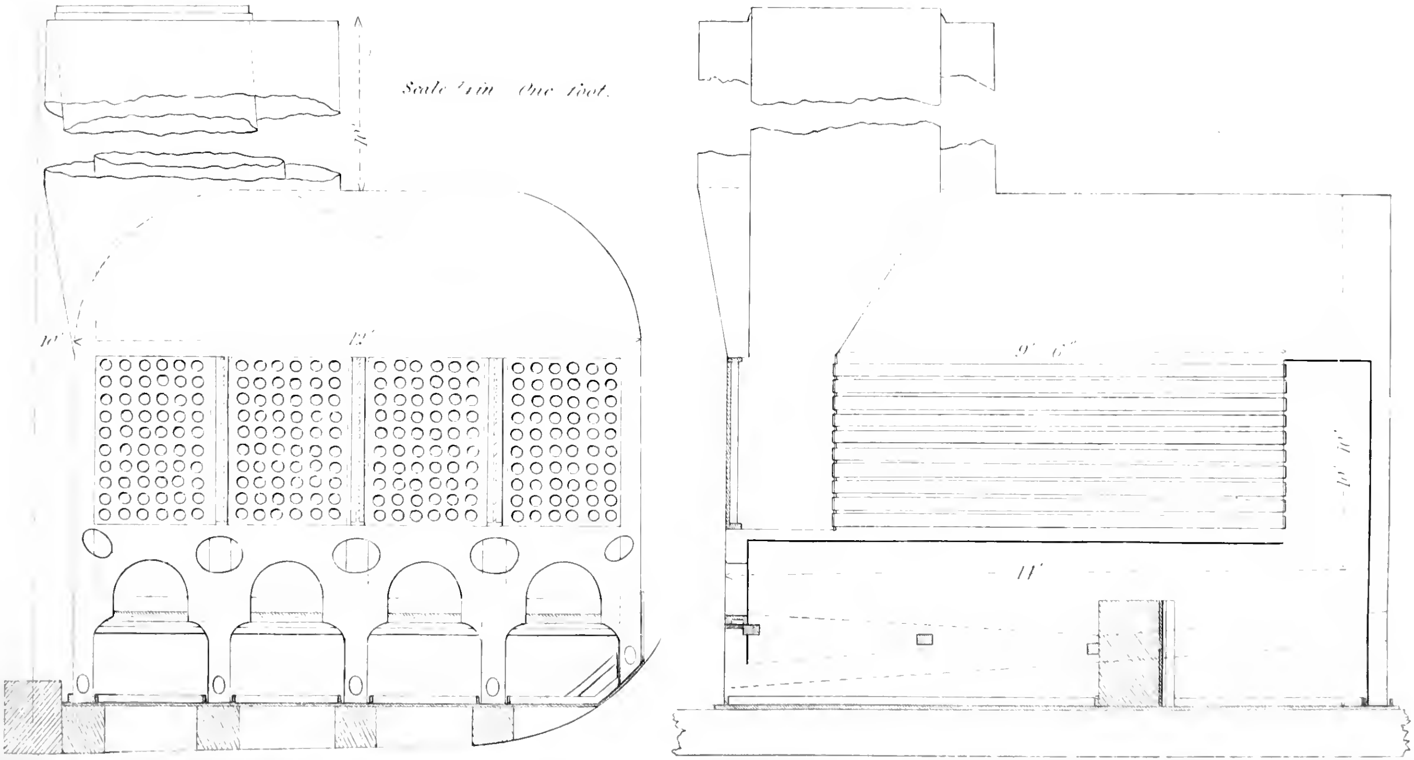
Mean draft of water on trial, forward,	10 feet 7 inches.
" " aft,	12 " $5\frac{1}{2}$ "
" " mean,	11 " $6\frac{1}{4}$ "
Midship section immersed at that draft,	345·5 square feet.

Time and distance made; downward trip.—April 27.

	Time.	Distance from starting point.	Tide and other rem'ks.
Passed Navy Yard Shears,	9h. 15 m. A. M.	Miles.	Ebb almost $\frac{1}{3}$ down.
" Fort Mifflin, (stopped 10 min.)	9 50 "	8·25	"
" Marcus Hook,	10 51 "	20·25	"
Stopped twice below Marcus Hook to repair disarrangement of valve gearing; in all	2 48		Met flood at 1 P. M. 30 miles below city.
" Delaware City,	2 51 P. M.	40·50	
" Ledge Lightboat,	6 8 "	77·00	Took ebb tide.
" Breakwater Lighthouse,	7 48 "	103·50	
Total time,	10 34		
Running time,	7 36	103·50	

Boilers of Steamer "State of Georgia"
BY
MERRICK & SON,
Philad^a. 1852.

Scale ¼ in. One foot.



Estimating the tide current $2\frac{1}{2}$ miles per hour, in favor $4\frac{1}{4}$ hours, and opposed $3\frac{3}{8}$ hours, the actual distance run was $103{\cdot}5-2{\cdot}2=101{\cdot}3$ miles, or, in still water, speed per hour was $\frac{101{\cdot}3}{7{\cdot}6}=13{\cdot}33$ statute miles.

Time and distance made, April 28.

	h.	m.			
Passed Breakwater Lights,	6 h.	3 m.	A. M.	on S. E. course.	Moderate breeze from S. W., and light swell; at 7 30, wind veered to the westward and came out strong from N. N. W.
Put about,	7	48	"	about 22 miles out.	
Passed into Breakwater,	10	3	"		Tide ebb; wind nearly ahead; continued till below Reedy Island, (3 30, P. M.); after which, wind abeam to the City.
Rounded past Lewes, Dela.					
" out of Breakwater,	10	20	"		
(Stopped 9 minutes.)					
" Ledge Light-boat,	12	49	P. M.	26·50	
" Delaware City,	3	50	"	63·	No tide till 4 h. 15 m. when flood tide overtook the vessel.
" Marcus Hook,	5	15	"	83·	
" Fort Mifflin,	6	5	"	95·25	Tide moderate, owing to N. W. wind blowing all day.
" Navy Yard,	6	37	"	103·50	
Total time,	8	17			
Running time,	8	8			

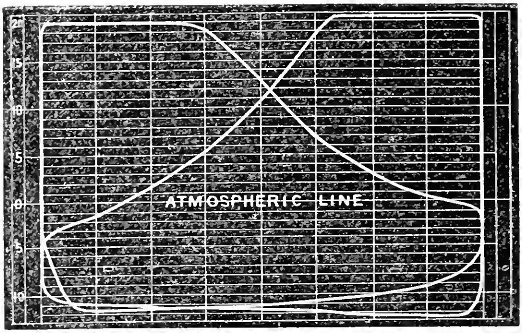
The force of the wind may be estimated by comparing the time running out and returning (22 miles,) at sea. $22\div1{\cdot}75=12{\cdot}57$, and $22\div2.25=9{\cdot}77$ miles per hour; difference owing to wind on return $=2{\cdot}8$ miles per hour. On the upward trip, tide in favor 2 h. 22 m., opposed 2 h. 42 m. Actual distance run, $103{\cdot}5-0{\cdot}7=102{\cdot}8$ miles in 8 h. 8 m., or $\frac{102{\cdot}8}{8{\cdot}13}=$ $12{\cdot}66$ statute miles per hour. Assuming the retardation from the wind at 2 miles per hour only, for one half the running time, would give the speed $=13{\cdot}66$ miles per hour.

The average pressure in boilers, pressure in cylinder, (from indicator cards,) number of revolutions, point of cutting off, &c., were as follows:

	1. Total duration. *Hours.*	2. Pressure of steam above atmos. *Boilers.*	3. Mean pressure above atmos. *Cylinder*	4. Effective pressure on piston.	5. Revols. per minute.	6. Mean point of cutting off.
Downward trip, ...	8·45	20·52	17·80	20·34	16·17	3 ft. 2 in.
Going to sea, &c. . .	4·27	21·50	16·75	19·95	14·80	3 " 1 "
Upward trip, ...	8·08	20·47	17·32	19·95	16·50	3 " $2\frac{1}{2}$ "
Average in river, . . .	16·53	20·50	17.56	20·15	16·28	3 " $2\frac{1}{4}$ "
Average in whole trip, .	21·20	20·70	17·40	20·10	16·05	3 " 2 "

There were taken during the trip, about 30 indicator diagrams, (of which four examples are given,) from which the above results were carefully averaged. The 3d column is the *average* pressure during admission of steam, and of course covers the effect of "wire-drawing."

No. 1.



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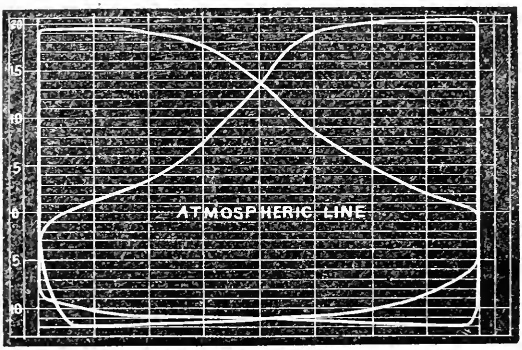

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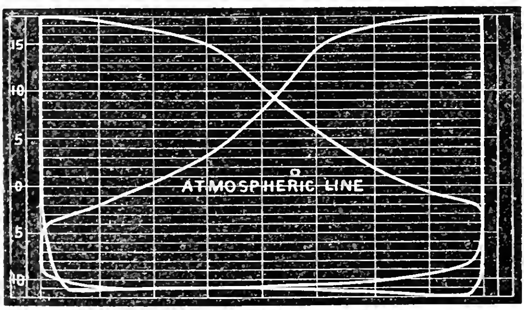

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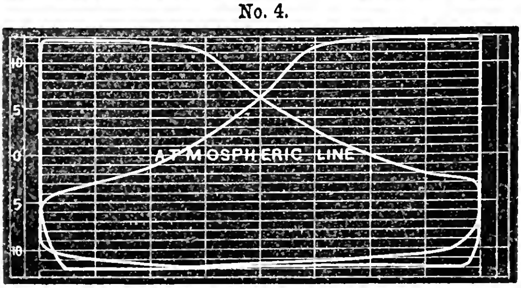


No. 1.—Taken at 3 h. 8 m. P. M., April 28th, Delaware River; revolutions per minute, 17; steam pressure in boilers, 21 lbs., cutting off at 2 ft. 10 in.; vacuum, 26 inches; throttle $\frac{5}{8}$-ths open; average effective pressure, $= \dfrac{21{\cdot}34+21{\cdot}23}{2} = 21{\cdot}29$ lbs.

No. 2.—Taken at 4 h. 48 m. P. M., April 27th, Delaware Bay; revolutions per minute, 18; steam pressure in boiler, $22\frac{1}{2}$ pounds, cutting off at 3 feet 4 inches; vacuum, 26 inches; throttle $\frac{3}{8}$-ths open; average effective pressure, $= \dfrac{22{\cdot}65+22{\cdot}03}{2} = 22{\cdot}34$ pounds.

No. 3.—Taken at 8 h. 55 m. A. M., April 28th, at sea; going in Capes, strong wind on port bow; revolutions per minute, 14; steam pressure in boilers, $20\frac{1}{2}$ pounds, cutting off at 3 feet; vacuum, 26 inches; throttle $\frac{3}{8}$-ths open; average effective pressure, $= \dfrac{19{\cdot}31+19{\cdot}38}{2} = 19{\cdot}35$ pounds.

No. 4.—Taken at 5 h. 30 m. P. M., April 27th, Delaware Bay; foretopsail and top gallantsail set; moderate breeze abaft starboard beam; revolutions per minute, $16\frac{1}{4}$; steam pressure in boilers, $14\frac{1}{2}$ pounds, cutting off at 3 feet 2 inches; vacuum, 26 inches; throttle $\frac{3}{8}$-ths open; average effective pressure, $= \dfrac{17+16{\cdot}75}{2} = 16{\cdot}87$ pounds.

Power developed and utilized.—Diameter of wheel at centre of pressure, at 4 feet $4\frac{1}{2}$ dip, $= 27{\cdot}68$ ft. = circumference $86{\cdot}96$ feet.

Downward trip; distance traversed by centre of pressure, . . .	$86{\cdot}96 \times 16{\cdot}17 \times 60 \times 7{\cdot}6 =$	641193
Actual distance traversed by vessel,	$101{\cdot}3 \times 5280 =$	534868
Slip = 16·58 per cent.		= 106325
Upward trip; distance traversed by centre of pressure,	$86{\cdot}96 \times 16{\cdot}50 \times 60 \times 8{\cdot}13 =$	700191
Actual distance traversed by vessel,	$102{\cdot}8 \times 5280 =$	542788
Slip = 22·48 per cent. (Head winds for one-half distance.)		157406

Or, if the deduction for the effect of wind (before alluded to) be made, the slip in still water would be 16·44.

Mean slip on both trips $\dfrac{16{\cdot}44+16{\cdot}58}{2} = 16{\cdot}51$ per cent.

And mean speed " $\dfrac{13{\cdot}33+13{\cdot}66}{2} = 13{\cdot}50$ stat. miles per hour.

Average power developed in the same time was

$\dfrac{4114 \times 20.1 \times 16{\cdot}28 \times 8 \times 2}{33000} = 652{\cdot}69$ horse power; or allowing $1\frac{1}{2}$ lbs. per sq. in. on piston for working engine, and 5 per cent. on the remainder for friction of load, we find $= \dfrac{4114 \times 18{\cdot}6 \times {\cdot}95 \times 16{\cdot}28 \times 16}{33000} = 573{\cdot}66$ horse power transmitted through the shafts; which at $86{\cdot}96 \times 16{\cdot}28 = 1415{\cdot}7$ feet per minute (velocity of wheel) becomes a pressure tangential to the circumference, of 13451 pounds. From oblique action of floats, (causing a loss of 17·5 per cent. at 4 feet $4\frac{1}{2}$ inches total dip,) this is equal

to a pressure available in propelling in a line parallel to the keel, of 11097 pounds, which is the resistance of the vessel at a velocity of $\frac{1415\cdot7\times\cdot835}{60}=19\cdot7$ feet per second.*

Hence, coefficient of vessel $=\frac{11097}{(19\cdot7)^2}=28\cdot60$, at this speed and in still water.

The proportion of total power utilized in propulsion is as $652\cdot69$: $\frac{1415\cdot7\times\cdot835\times11097}{33000}=652\cdot69:397\cdot47$, or as $1\cdot00:0\cdot609$, or nearly 61 per cent.

CONSUMPTION OF FUEL.—Good Buck Mountain, (anthracite.)

An accurate record of coal used, was kept during the trip. From the time of leaving the wharf to the time of returning to it, there were consumed 398 buckets, each weighing 103 lbs. = 40994 lbs.; of this it is supposed that 1000 to 1500 lbs. was used in banking fires at the Breakwater, from 8 P. M. to 6 A. M., April 28, and in raising steam; that being a matter of uncertainty, however, may be neglected, and we find for the consumption $\frac{40994}{21\cdot3}=1922$ lbs. per hour; 21·3 hours being the whole time during which the engine was working.

EVAPORATING EFFECT.—

Average point of cutting off, . .	3 feet 2 inches of stroke.
Clearance at each end of piston, . .	1·25
Space in each nozzle and steam chest, .	2
Total admission each single stroke,	3 " 5·25 inches "

Then volume of steam used per minute, $=3\cdot4375\times2\times16\cdot05\times28\cdot27$ $=3120$ cu. ft.; average pressure, (see table,) 20·10 pounds, of which volume = 827, so that

$$\frac{3120}{827}=3\cdot772 \text{ cu. ft.}\times62\cdot5=235\cdot75 \text{ lbs water evap. per min.}$$

$$\text{and } \frac{1922}{60}= \qquad 32\cdot03 \text{ lbs. coal used} \quad ``$$

$$\frac{235\cdot75}{32\cdot03}=7\cdot360 \text{ for fresh water.}$$

For about one-fifth of the time (at sea,) the water was maintained at $\frac{1\cdot5}{32}$,

*A convenient formula embodying this calculation is,

$$C=\frac{A\,P\,L.\ \sin.\ ^2\delta}{\cdot0043\ D^3\ R^2\ (1-s)^2}$$

When C = coefficient of vessel.
A = area of cylinder in inches.
P = pressure in cylinder effective for propulsion, after deducting for working engines and friction.
L = length of stroke in feet.
D = diameter of wheels at centre of pressure in feet.
R = revolutions per minute.
s = per centage of slip.
δ = angle of which the sine is the mean of the sines of all the angles contained within the limits of unity and the entering angle of the floats in the water.

which at a temperature of 110° feed water, and 260° in the boilers, causes a loss of 16·9 per cent. in the whole amount, during one-fifth the time, or for the whole time, $\left(1+\frac{16\cdot9}{83\cdot1\times5}\right)\times7\cdot360 = 7\cdot660$ lbs. water to a pound of coal.

No foaming was observed in the boilers during the trip.

For the Journal of the Franklin Institute.

Explosion of the Steamer Redstone. By Thomas Bakewell, Esq.

To the Committee on Publications.

The steamer *Redstone*, on which the explosion occurred, was a new boat, built at Brownsville, Pa., with three boilers, 42 inches diameter, and two flues, each 15 inches diameter. She plied as a packet between this place and Madison, 100 miles below, and was owned by parties in that place. The explosion happened 12 miles this side of Madison.

I have annexed the answer to my letter of inquiry to Mr. Sopher, the Clerk of the boat. The Captain may in a few weeks be able to visit this City, when I shall not fail to see him.

You will please observe that Mr. Sopher states that "the opinion of Captain Pate was, that the water must have been too low." This "opinion" arises not from any facts justifying it, but is a sample of the prevailing idea, that boilers cannot burst with plenty of water.

There can be no question in this case, that the accumulation and retention of steam under the constant expectation of being able to "go ahead," and then the prolonged delay of the engine hanging on the centre, was the cause of the explosion.

I enclose a newspaper account of the explosion of the *Redstone*, and also that of the *Glencoe* at St. Louis, giving the *testimony* of an assistant engineer, (say opinion of himself and friends,) as to the cause. This newspaper slip of the St. Louis explosion was shown to me as the strongest case known, conflicting with my views of explosion, viz: that boilers burst simply from excess of steam, and that want of water contributes only so far as the metal may be heated and weakened thereby; that in no case of water on a heated part of a boiler, can steam be generated in quantity so suddenly as to explode the boiler, without previous indications by the safety valve, or any approach to it, although steam *may* be generated from that or other cause more freely than the safety valve will *continue* to discharge under its usual weight.

The very disastrous explosion of the boilers of the *Moselle* at this place in 1836, was followed by the usual newspaper statements and verbal gossip, of want of water, boilers red hot, hydrogen gas, &c.; and persons were ready to testify to pieces of the boilers being red hot, as they flew through the air.

The boilers, as arranged in the boat, side and side, about 3½ inches apart, are connected near the fire end by a double concave cast iron washer, 7 inches diameter, with a hole in the middle, 2 inches diameter, to meet corresponding holes in the boilers, for a water passage, the joints between each side of the washer and boiler being made with lead. This

kind of joint is over the fire, and apt to give trouble in ordinary circumstances by the lead melting out.

Now, a piece of each of the two boilers, still connected as above described, was found and examined by myself and others, the lead joints of which were perfect. We also found the lead joints of the manhole and connecting cross pipes in their original perfect state.

From the above facts, it is evident that the water must have been at least three inches above the middle of the boilers, which would cover (or nearly so) the flues.

Cincinnati, April 22, 1852.

Letter from Mr. Sopher.

The *Redstone* left Madison at 12 o'clock, 3d of April, for Cincinnati. She took in tow at the time a loaded corn boat, containing about 2000 bushels, for Carrollton, a distance of 12 miles, and made it in the usual time, say one hour and thirty minutes. After leaving the corn boat, we landed at the wharf, and remained fully ten minutes, taking on eight passengers. We then got under weigh, and after running $3\frac{1}{2}$ miles, landed at Scott's Farm, on the Kentucky shore, where we took on the Rev. Perry A. Scott.

At the time the wind was blowing hard ashore, and instead of backing out as usual, she only commenced backing down the shore, the wind preventing. The Captain then gave the order to stop backing, and go ahead on the starboard wheel, that being the wheel next the shore. Instead of going ahead, the engine "caught on the centre," and whilst the engineer was working the levers, two of the boilers exploded.

I am unable to say how much steam we had on at the time, but usually carried 140 pounds, and have had as high as 170 pounds, which was the most I have ever known. Nor can I tell you any thing in regard to the water, as the first engineer of the watch was killed. The opinion of Capt. Pate was, that the water must have been low.

Aurora, April 30, 1852.

Extract from the Newspaper Account.

The question naturally arises as to the cause of the explosion. It is a notorious fact, that she has been "shoved," and in for a race, whenever she came across another steamer, making it a rule to pass her under weigh if possible. The following paragraph from the Madison *Courier* of Saturday tells its own tale:

"The steamer *Redstone* came in last night with some eighty passengers and a fair freight list. The *Redstone* is one of the fast *ones*, as the crack steamer *Buckeye* found out yesterday, after laying out in the river to wait for her. The *Redstone* took her on the wing—passed her under weigh easy. Captain Pate is very much elated—thinks of making a fast run from Louisville to Cincinnati."

From all the information we can gather, the boat was heavily charged with steam, in case another steamer came along, and the consequence was, the explosion of the boilers on the fourth revolution of the wheel.

The Cause of the Explosion of the Steamer Glencoe.

We made mention in yesterday's issue of the fact, that Mr. John Ryan, one of the assistant engineers on the steamer *Glencoe*, had made some

dying declarations in relation to the explosion of the boilers of this ill-fated boat. Yesterday noon we met with two brothers of the deceased, who were present when these disclosures were made, and from them glean the following facts, in substance the same as said by Ryan on his death-bed.

A short time previous to his death, Mr. Ryan called those into his room, among whom were his two brothers, residents of Alton, Mr. Samuel Rogers, a respectable brass founder on North Main street, and others, and told them that he desired to make a statement previous to his death, which he felt assured was near at hand.

He then went on to state that, on the evening of the arrival of the *Glencoe* at this port, himself and George Buchanan, first engineer of the boat, were on watch. Some time before reaching port, he (Ryan) tried the water in the boilers, and found it very low, and called to B., and informed him of the fact, and received some evasive answer. He again tried the water, and again called to Buchanan, who told him to mind his business, that there was water enough in the boilers, and he would take her with it to St. Louis or to h–ll.

Not satisfied, Ryan expostulated, and Buchanan told him in substance that it was his (Buchanan's) watch, and that he (Ryan) had nothing to do with pumping up, and, moreover, that if he (Ryan) had his way, he would have the water from the boilers running out at the tops of the chimneys. Subsequently Buchanan remarked that the boat was making good time, and he would take her into St. Louis kiting. This was perhaps the last remark made, and when the boat reached the wharf, and commenced trying to effect a landing, Buchanan turned on the gauge-cock, and let on the water. The instant the cold water came in contact with the heated boilers, now nearly dry, the explosion took place.

This statement was made, we understand, over three or four times, at the solicitation of the dying man's friends, who thought, perhaps, his mind was wandering. He was told the weight and importance of his declaration, and was asked if he was not out of his right mind; to which he replied, that he was perfectly conscious of what he was saying and doing; that his declaration were facts, and that he designed making the same statement in the event of his recovery, and now that he felt conscious of his approaching end, he was the more anxious to unburthen his mind. In a short time after, Mr. Ryan breathed his last.

We give the facts substantially as related to us, without exaggeration. Comment is unnecessary, the declarations speak for themselves.

St. Louis Intelligencer, April 9.

For the Journal of the Franklin Institute.

Explosion of the Steamboat "Mary Kingsland." By A. C. Jones, Eng'r. (*With a Plate.*)

To the Committee on Publications.

On February 29th, 1852, at 6 o'clock, A. M., about 30 miles below New Orleans, the tow boat *Mary Kingsland* exploded the starboard middle boiler. She had in tow, a ship, a barque, two brigs, and a schooner, and

was running steadily at the time of the explosion. Eight persons died from injuries received, and much damage was done to the boat and engine.

The *Mary Kingsland* was originally a ship, which was burned to the water's edge, and since being converted into a tow boat, has had three explosions on her,—one about a year since, after which four of the six boilers were replaced with others, the one marked *a*, (Plate VIII.,) and the one now destroyed being the old ones; their after heads are *half* cast iron. These two have a water space between the flue and shell of 3½ inches; the others have only a space of *one and a half inches.*

The diagram gives the position of the iron fragments of the boiler and its appendages. As the force of the explosion was upwards and aft, of course much of the woodwork is destroyed. *b* is the foremast, *c* is a large piece of the shell, flattened and partly doubled up; many fragments of the front cast iron head is attached to it; *d* is the two starboard boilers, bottom upwards, the chock joint (forming the water connexion between them) being in good order. Above the other boilers, at *e*, is two-thirds of the steam drum, and its steam connexion pipe; all the joints have been torn from the tops of the boilers. Forward of this, on the top of the fragments of the boiler deck, is an upper section of one smoke pipe, uninjured; at *f*, on the main deck, is the other smoke pipe, in good order. The breechen of these pipes is only partially injured. *g* is part of the standing pipes, through which the supply of water from the pump passed to the boilers; *h*, a piece of flue, (round,) much torn at one end; the other end has nine-tenths of the holes in good order. *i*, is a straight flat piece of the shell, the widest part being 23 inches; this piece is nearly a foot longer than is due to the perimeter of the boiler. Near this is a piece of flue, *k*, about 18 inches long, with some fragments of the front cast iron head attached to it. About eight feet abaft this, *l*, is half of the cast iron front head of the boiler; all the holes in the rim are in good order. About ten feet further aft, we come to the principal part of the boiler, its after end resting on the paddle wheel shaft. Fig. 2 gives the shattered appearance of the end, both the cast and wrought iron part of the head being much ruptured. Ten feet of this shell retains its cylindrical form, except a large flattened piece, which stands out at a tangent from it. The shell is much corroded, and there are two large patches on the bottom, and a small one on the side. The iron is much laminated, and appears of a very bad quality. The highest water line inside shows that this boiler had been worked with *the water just covering the flues;* one gauge cock is two inches above the line of the flue tops, and the other one and three-quarter inches above it. What had been the inboard flue, *m*, is collapsed its whole length, 18 feet; the other flue, 17 feet 6 inches long, is cylindrical; half the rivets at its end are cut clean off, and remain in the holes; another part has a piece of flue sheet torn off outside the rivets; *n* is a piece of flue unchanged in form, 8 feet 6 inches long, having a hole in its side, about the size and shape of a man's hand; this piece of flue is exactly at right angles to the part of the flue in the shell, and singularly, the end *o* belongs to the end of the flue still fast to the head of the boiler. At *p*, under the flues, lies the manhead in a perfect state.

New Orleans, April 2, 1852.

Explosion of the

MARY KINGSLAND.

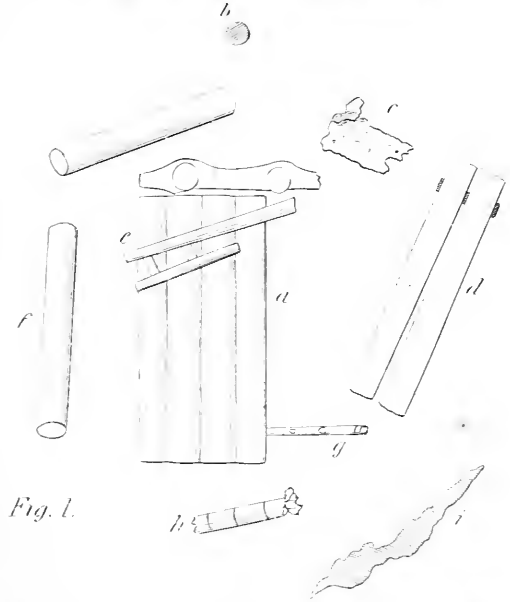


Fig. 1.

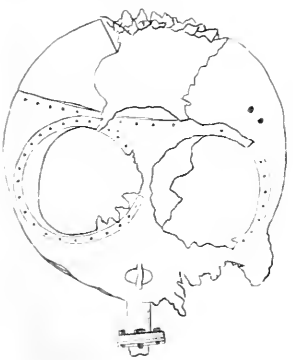


Fig. 2.

For the Journal of the Franklin Institute.

On Marine Propulsion. By J. V. Merrick.

It appears from the last "Reply" of Mr. Nystrom, published in the May number, that he is still unable to understand the true theory on the slip question. Possibly this might not have been the case, had he read attentively what he professes to criticize; in which case he would not have compelled me to notice one or two instances of misrepresentation, which are evidently the result of carelessness in reading.

The first passage to be noticed reads as follows:

"Now, after Mr. M.'s lengthy disquisition, "that slip is no loss of effect," he comes to the conclusion of my first formula: $p\ v = r\ s$, or, as Mr. M. expresses it, $p : r = s : v$, in which

p = coefficient of the vessel.
r = area of floats multiplied by the coefficient for resistance to plane surfaces.
v = velocity of the vessel.
s = velocity of the water backwards (slip).

This is a proof that slip is *no* loss of effect. The effect delivered from the steam engine $r\ s = p\ v$ the useful effect.

After Mr. M. has embodied the formula, he condemns it as wrong, and says it should be $p = r$.

If Mr. M. had substituted *resistance* of the vessel instead of *coefficient*, it would have been all right. But this "coefficient" makes the remainder of his article wrong."

If Mr. Nystrom will turn back to his own article in the March number, p. 200, he will find the following notation, which precedes the equation commented upon:

"p = mean thrust of dynamometer in pounds;
r = resistance to the propeller in pounds," &c., &c.

If he will then read again the definition given of the term "coefficient," (vide note, foot of p. 272,) and the examples given to illustrate it in the case of the *San Jacinto*, he will see that (the same notation being adopted) $p = Cv^2$, when C = coefficient of the vessel, and v its velocity, and that p and r are simply convertible terms, since the resistance of the propeller in pounds is precisely the same as that of the vessel in pounds; in other words, the 12,815 pounds measured by the dynamometer of the *San Jacinto*, expresses either the pressure of the propeller backward against the water, or the resistance opposed by the vessel at the velocity at which it was moving forward—one of the very *elementary* principles in mechanics.

The assumption, therefore, that I have first condemned and then embodied Mr. Nystrom's formula, is entirely gratuitous.

To have substituted, as he suggests, the term, *resistance* for *coefficient*, would have been correcting (?) that which was right before.

Again: in the course of his remarks, Mr. N. indulges in some facetious observations respecting "square radius," and "square degrees," based upon a typographical omission in the text; for a correction of which he is referred to the "Errata" in the May number. Notwithstanding this omission, the result obtained was correct, as a little calculation would have shown him.

In this connexion it may be remarked, that although the projected area of the *San Jacinto's* propeller was inadvertently misquoted, an examina-

tion of the context will show what was *intended.* The error affected only that particular case, and not the principle involved; showing only that a higher coefficient for the resistance of plane surfaces obtained in that instance, than ·845, which was therein deduced. The true coefficient was 2·347.

But to prolong this discussion will be of little avail: the arguments, *pro* and *con*, are before those who take any interest in the subject. I shall, therefore, conclude what I have to say, by showing to Mr. Nystrom the fallacy of the argument on which he relies for proof—an argument on which he appears to have expended a vast number of figures and equations.

To demonstrate this point, we have only to examine the diagrams by which the argument is illustrated.

We there find that a fulcrum, which has always been supposed to be a point of support for the action of the power, in propelling a vessel as well as in moving any other resistance, is an imaginary point in the area of a paddle wheel, situated somewhere between the shaft and the immersed float—the position of this point being determined merely by the ratio between the advance of the vessel and the slip. This is a very convenient (for the argument) and quite original method of viewing the lever. There is only one trifling circumstance overlooked, which is, that the "fulcrum" moves over space in the same direction and with the same velocity as the resistance.

To those who are content with the old method of considering the lever, it is easier to suppose that the fulcrum is in the water; that this fulcrum recedes a certain proportion of the whole movement due to the power; and that the resistance is moved over a space equal to the difference between these two spaces: in other words, that the arm of a paddle wheel is to be judged of precisely in the same manner as the arm of a locomotive driving wheel.

For the Journal of the Franklin Institute.

On the Comparative Value of Anthracite and Bituminous Coals for the purpose of Generating Steam.

Congress has recently called on the Secretary of the Navy for the report of the Engineer in Chief, Charles B. Stuart, Esq., on the comparative value of the two different kinds of coal for the purpose of generating steam. Some years since a large number of experiments were made by Professor Walter R. Johnson, from samples of coal furnished by miners, all of which were published by authority of Congress; and in consequence of the result of those experiments, the naval steamers have been supplied with Cumberland coal, very much to their injury and expense.

The only true test of the comparative value of coal is to take the two kinds as they are delivered at your ship, stowed in the bunkers, and brought out at your boilers ready for use. The anthracite will undergo all this without change, while the Cumberland, from its friable nature, becomes reduced almost to a powder.

The experiments of Mr. Stuart are from two lots of coal delivered at the New York Navy Yard, and the contents of the large stone dock at that station have been several times pumped out with each kind. The result has not yet been made public, but it is understood that the anthracite is about 50 per cent. cheaper than the bituminous, the difference in cost of each per ton being considered.

Many of our naval engineers have for several years past been strongly in favor of anthracite coal, owing to the very great trouble of getting any Cumberland suitable for steaming. The steamer *Fulton* is fitted for anthracite; the *Saranac* recently took in 150 tons of it at San Juan de Nicaragua, and her engineer prefers it to bituminous; the *Mississippi* now has 300 tons in her bunkers, for her next cruise; and, in fact, the general feeling is in its favor, and this feeling is in a great measure caused by the want of mechanical strength in the Cumberland coal, to withstand the necessary handling before it reaches the furnaces. In this respect the Cumberland is inferior to most coals of that class, particularly the English. The *City of Glasgow* burns Cardiff coal on her trips to this port, and is enabled without difficulty to carry a fair pressure of steam. On her return, she burns Cumberland, and cannot make steam sufficient even with an increased supply of fuel.

In addition to the economic value of anthracite coal, it is entirely free from all danger of spontaneous combustion. B.

For the Journal of the Franklin Institute.

On Ericsson's Caloric Engine.

Messrs. Hogg & Delamater, of New York, are constructing for and under the superintendence of Captain Ericsson, a pair of very large caloric engines, intended for a vessel of about 1900 tons, and every possible exertion is being made to have her ready for sea in September. It is not my purpose to discuss the merits of this engine at the present time, deeming it sufficient to say, that after many years of active exertions, Captain E. has at last perfected to his own satisfaction and that of his friends, his caloric engine. It has been fully secured by patent in this country and in Europe. A model engine of 60 horse power has been in operation at the works of Messrs. H. & D. for months past, and it has been repeatedly tested to their entire satisfaction.

The machinery for this vessel will be a pair of engines, one abaft the other, in line with the keel of the ship. Each engine has two cylinders (single acting) of the diameter of 14 feet, with 6 feet length of stroke. To each engine there is one beam, and the connecting rods from both engines take hold of the same crank-pin, but from the position of the engines, both are not on the centre at the same time. There are two air pumps to each engine, for forcing the proper quantity of air into the receiver; their diameter is 137½ inches, and stroke same as that of the cylinders, directly over which they are secured. The pistons of the two are connected together by several rods, and it is from the lower side of the air pump piston that the power is communicated through the beams to

the cranks, on the shafts of which are side wheels, about 32 feet diameter, and 8 feet face.

Should the practical operation of this ship prove successful, 100 tons of coal is expected to do the work of 1000 tons in the steam engine, and the advantages that would accrue to the world cannot be estimated.

For particulars of the patent, see *Journ. Frankl. Inst. vol.* xxii. 228.

B.

For the Journal of the Franklin Institute.

Notice of the Naval Dry Dock and Railway at Philadelphia.

The United States Dry Dock at this port having recently been completed, was successfully tested during the past month by the lifting and hauling out of the steam ship *City of Pittsburg*, of 2200 tons burthen. This Dock and appendages being the largest in the world, merits more than a passing notice. The lifting power consists of nine sections, six of which are 105 feet long inside, and 148 feet over all, by 32 feet wide, and $11\frac{1}{2}$ feet deep; three of them are of the same length and depth as the others, but 2 feet less in width; the gross displacement of the nine sections is 10·037 tons, gross weight 4145 tons, leaving a lifting power of 5892 tons, which far exceeds the weight of any vessel yet contemplated. The machinery for pumping out the sections consists of two engines of 20, and two of 12 horse power. In connexion with the sections (which form the lifting power of the dock,) is a large stone basin, 350 feet long, 226 feet wide, and 12 feet 9 inches deep, with a depth of water of 10 feet 9 inches at mean high tide.

At the head of this basin are two sets of ways, each being 350 feet long, and 26 feet wide. These ways are level, and consist of the bed pieces, which are three in number, and firmly secured to a stone foundation; the central way supports the keel, while the side ways receive the weight of the bilge; these ways are of oak, and are finished off to a smooth surface. On the top of the bed pieces or fixed ways, comes the sliding ways or cradle, which are also 350 feet long and 26 feet wide, so constructed as to admit of being adjusted to the length of any vessel.

The operation of the dock is as follows:—The sections are sunk so as to allow the vessel to be floated in; as soon as she is secured in the proper position, the pumps are put in operation, when the sections begin to rise, and as soon as they come to a bearing on the keel, the bilge blocks are run in until they fit the ship. When all is secure, the sections are pumped out until the keel is some two or three feet above the water. If repairs that will only require a short time are contemplated, the vessel is kept on the sections, and no other portions of the dock used. But the *Pittsburg* was taken up for the purpose of testing the several parts of the dock, and after she was lifted out of the water the sections carrying the ship were floated into the basin in line with one of the sets of ways. When this is accomplished, the sections are filled with water, and rest on the bottom of the basin, which is of stone. Bed ways are now laid on the sections in line with those before mentioned. When they are secured they are greased, and the cradle is now slid under the ship, and she is

blocked up on the cradle, and the blocks on the sections are removed. At this point of the operation a new instrument of power is brought forward for the purpose of hauling the ship from the sections on to the bed ways in the Navy Yard. It consists of a large hydraulic cylinder, having a ram of 15 inches diameter and 8 feet stroke, and a power of 800 tons. On the top of this cylinder, and attached to it, are two vertical direct acting engines, with cylinders 16 inches in diameter and 16 inches stroke, connected at right angles to one shaft, on which are four eccentrics for working four hydraulic pumps of $1\frac{1}{2}$ inches bore, and 6 inches stroke; the tank which carries the water for the press is also on the top of the cylinder, and forms the bed on which the pumps are secured. The boiler which supplies these engines with steam, is on a sliding cast iron bed way, some 12 or 15 feet ahead of the hydraulic cylinder, and connected to it by two cast iron rods. This boiler is of the usual locomotive form, and has 85 tubes of 2 inches diameter, and 9 feet long. To get ready for operation, the hydraulic cylinder is slid down to the edge of the basin, its ram is run in, and a connexion made by means of two side rods of wrought iron from the cross head of the ram to the sliding cradle which carries the ship. The central bed way has key holes mortised through it horizontally, every 8 feet, and there are projections from the hydraulic cylinder, which have corresponding key holes in them. Two cast iron keys, 24 inches wide, and 6 inches thick, are slid through the key holes on small wheels; these keys secure the cylinder to the central bed way; the engines and pumps being now put in operation, a pressure is brought on the 15 inch ram, and as soon as the pressure overcomes the resistance, the vessel must move. The estimated weight of the *Pittsburg* was 2800 tons, exclusive of the sliding ways and blocking; the power required to start this weight on a level, greased [surface, was 250 tons. As soon as the vessel has been moved 8 feet, the keys which hold the cylinder to the central way are withdrawn, and by means of a screw which is attached to the head block of the ram, and driven from the engine, the cylinder and boiler are in their turn rapidly slid ahead, (the water in the cylinder being allowed to escape into the tank,) when the cast iron keys are again slid in place, and the vessel moved another 8 feet. After the first starting of the *Pittsburg*, the power required to remove her was but 150 tons, and she was moved 260 feet in 6 hours. To push the vessel off, the cylinder and appendages are moved to the head of the ways, put on a turn-table and reversed, when it is again brought down to the cradle, and the cylinder being secured as before, the head of the ram is applied directly to the cradle, and the vessel shoved back on to the sections, which requires the same time and power as to haul them off. In docking and hauling out the *Pittsburg*, every part of the work gave the most entire satisfaction, no portion showing the least defect, and the time required to go through the various operations being less than was expected. But six sections were used for lifting in this operation, leaving three unemployed. It will at once be seen that the capacity of this dock exceeds that of the stone docks at New York, Boston, and Norfolk, combined, for united they can take but three vessels, while here, two of our longest war steamers may be hauled out on the ways, and two frigates lifted on the sections. The advantages that

must result from the facilities of repairing a vessel elevated into light and air over one sunk in a stone dock, are very great, and have only to be seen to be appreciated. I am indebted to the work on Naval Dry Docks, recently published by Chas. B. Stuart, Esq., Engineer in Chief, United States Navy, for many of the details of this article. B.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, May 20, 1852.

Thomas Fletcher, Vice President, in the chair.

Owen Evans, Recording Secretary, *Pro. Tem.*

The minutes of the last meeting were read and approved.

Letters were read from A. Vattemare, Esq., Paris, France; The Zoological Society, London; and Prof. A. D. Bache, Coast Survey, Washington City, D. C.

Donations were received from The Minister of the Interior, Agriculture, and Commerce, of France; The Zoological Society, and The Chemical Society, of London; Prof. A. D. Bache, Coast Survey, and The Smithsonian Institute, Washington City, D. C.; Hon. Joseph R. Chandler, S. G. Haven, and John Robbins, Jr., Members of Congress; Charles B. Stuart, Esq., Engineer in Chief, U. S. Navy; John P. Whipple, Esq., Engineer, U. S. Navy; William J. Lewis, Esq., San Jose, California; Dr. T. S. Kirkbride, Seth Craig, Esq., Dr. L. Turnbull, and Dr. C. M. Wetherill, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of April.

The Board of Managers and Standing Committees reported their minutes.

The Special Committee on the Law for the Ventilation of Buildings, presented their report, and were discharged.

New candidates for membership in the Institute (6) were proposed, and the candidates (6) proposed at the last meeting were duly elected.

Dr. Rand exhibited some further specimens of Hyalotypes, taken by the Collodion process, by Dr. C. M. Cresson, to which he had called the attention of the members at the last meeting. By the addition of bromine the sensibility of the film had been much increased. The pictures exhibited were taken in from six to thirty-two seconds in diffused light, in one-quarter and one-half seconds in the open air.

Dr. Wetherill brought forward a piece of water pipe which had been buried and in constant use in this city for 24 years, and showed but a slight incrustation of oxide. He had found the coating, on analysis, to consist of a mixture of protoxide and sesquioxide of iron, with traces of silica, carbonate of lime, and magnesia, and fourteen per cent. of volatile matter.

Mr. Graff remarked that in certain cases in Boston and New York, the oxidation of the pipes was very rapid, while with us it was usually slow. Some discussion arose on the causes of this discrepancy, and the mode of protecting the pipes.

Dr. Turnbull exhibited a map of the telegraphic lines in the United States, and gave a history of the progress of telegraphic communication in this country.

Dr. Rand further exhibited a drawing, which he had received from Mr. Bartol, of the fracture of the centre shaft of the Steamer *Hermann*. The shaft broke square off between the crank and journal. That portion which is white in the annexed cut is the part of the shaft that was solid at the time of the fracture; the black portion was very much discolored by oil and dirt, and had evidently been cracked for some time.

Mr. Henry Francis presented a specimen of glazed sheet iron ware. Mr. Francis remarked that he was about to commence the manufacture of this ware on a large scale in this city.

Mr. J. V. Merrick exhibited a specimen of the new wrought iron tube for external pressure, manufactured by Thomas Prosser & Sons, in New York. This tube is joined mechanically and without brazing or welding, dependence being had for tightness under pressure on the previous preparation of the edges. It was stated that this tube had been applied in several boilers in England, and recently in New York, giving satisfactory results. The advantages claimed for it were the increased strength and diminished probability of corrosion, owing to the preservation of the *surfaces* of the original boiler plate from which the tubes were made, which, in the old plan, are abraded by passing through dies.

He also called the attention of members to specimens of compressed fuel, supposed to be a conglomeration of powdered bituminous coal, tar, and clay, which had been brought from England by the Steamer *City of Glasgow*, and still retained nearly its original form after passing through the coal bunks.

BIBLIOGRAPHICAL NOTICES.

Memorial of ALFRED GUTHRIE, *a Practical Engineer, submitting the Results of an Investigation made by him into the Causes of the Explosion of Steam Boilers.*

To a person who has not made himself practically familiar with the steam engine and its applications, it must appear very singular, that there is such an irreconcilable diversity of opinions set forth by writers on the subject, not only as to the best method of using this power, but particularly as to the dangers accruing in its use, and the best modes of avoiding these risks. Especially would it appear strange to one, familiar with the study of science, that in a matter so exclusively physical, recourse should be had so continually to the most mysterious agencies, to account for the terrific explosions with which almost every electric wave from the west comes loaded. The reason for these anomalies is, however, easily to be found by the searcher, in the rapid advance of the use of steam power in our country, which has so far outrun the power of our

population to supply it, especially in the West, where labor is in such demand, and the competition in business is so great, that the place of engineer in charge of a steamboat, including as it does, the responsibility for the lives of hundreds of passengers at a time, is frequently, indeed most frequently intrusted to persons, who are in no wise fitted either by previous education, or by mental or moral habits, to be entrusted with such responsibilities.

When under such inefficient administration, the proper precautions are neglected, and an explosion ensues, it becomes necessary to find some explanation for the phenomena, which shall not point to a fault, on the part either of the builders of the engine and boat, the owners, captain, engineer, sub-engineer or hands; and so electricity, the spheroidal state, magnetic repulsion, are taxed beyond their powers, and each novelty in science is necessarily grasped at to account for these fearful phenomena, to the investigation of which, according to the laws of common sense, no law of the United States, nor any officer of state or county is competent.

Many years ago, at the request of the U. S. Government, the Franklin Institute appointed a committee to investigate the causes of explosion of steam boilers, and the means of preventing such accidents, which committee made a report which has become classical in this branch. Since that, we have had nothing on our side of the Atlantic sustaining the principal and satisfactory views here expressed, until the memorial to Congress, whose title stands at the head of our article. Here, however, we have the production of a practical steam engineer of Chicago, who has devoted a considerable portion of time to the investigation of this very interesting matter, and whose results are precisely in accordance with those before arrived at by Messrs. Bache, Reeves, and others of the Franklin Institute committee. Mr. Guthrie in his very able pamphlet, handles the subject in an entirely practical way, and rejecting all mysterious agencies, attributes the explosion of the steam boilers of our Western boats—First, to the faulty materials or faulty construction of boilers; secondly, to badly arranged relations between the power of the engines and the resistance of the boats; thirdly, to the neglect of those in charge, either in permitting the elastic force of the steam to increase beyond the cohesive resistance of the boiler, or in permitting the water to become low, and thus to present a heated surface of metal, which, under certain circumstances, is necessarily followed by a tension of steam which no boiler shell can withstand. This branch of the subject is of such importance that we shall make no excuse for presenting to our readers a portion of Mr Guthrie's remarks and illustrations of the subject, which we do the more gladly, as they will well express our own views on this subject, in opposition (practically) to the remarks on this subject by an esteemed correspondent in the present number of the Journal, page 413.

"Explosions produced through the *gradual increase* of steam within the boiler, probably, are not of as frequent occurrence as from other causes; yet, explosions have undoubtedly occurred from this alone, and as yet nothing has been introduced to prevent the same occurrences from the same cause. By far the greater proportion of explosions are produced by a *sudden* increase of steam beyond the ability of the safety-valve to relieve, or the powers of the boilers to resist, and almost always occur-

ring within a minute or two after starting the engine. These facts are well known to all who have in any manner inquired into these subjects; they are so well known as to require no proof in confirmation of them.

"In order more fully to explain the cause of this, I must refer to plate 2. Fig. 2 represents a boiler in which the water has become low, no matter from what cause. It will be seen that the top of the flues have become uncovered, and the water receded down to the middle of the flue; the boat is supposed to be lying at her landing, with steam up ready to start; the fire passes along on the under side of the boiler, and returns through the flues. As shown in plate 4, it will be apparent to any one that the flues will be heated on the top just in proportion to the intensity of the flame urged through them; the sides of the boiler above the water line will also be heated in like manner, as far up as it is allowed to reach. Supposing this to be continued until all these parts are at a red heat, so long as there is no escape of steam from the safety-valve, or to the engine, the surface of the water remains nearly smooth, apparently unagitated; but the instant an escape is opened from any cause, the water is set in violent commotion, forming air or steam bubbles and froth, with a tendency always to follow the discharge of the steam overcoming these heated surfaces, and augmenting rapidly the volume of steam in the boiler, falling short of or exceeding its powers of resistance, as may be.

"It is the case frequently, when water is low, that it can be found in the gauge-cock, simply by surging or lifting the safety-valve, in consequence of the tendency of the water and steam to rush towards the discharging point.

"I will now suppose a steamboat as lying at her landing, water low in the boilers, the flues uncovered, and heated to a red heat; the steam has been prevented from escape, and gradually increased in density until it is at or near the exploding point—perhaps designedly by the engineer, for the most reprehensible design of making a great display on leaving the port. It is often that this condition of things is produced by the engineer, for no other motive than that of passing up and down before a town merely in wanton display, and sheering close along the shore, in order to augment the swell and attract attention. It should be remembered, that although this "may be sport" to the engineer, it may terminate in something worse to the passengers. However, we will suppose this state of things is existing. Now, if the engine should be started, the boat careened, or, by any casualty, water should be thrown upon these heated surfaces, it is as plain as that two and two make four, that steam will be generated; and if that should be more rapidly than the safety-valve can discharge, an *explosion must follow*, unless the boilers are strong enough to confine it.

"Hundreds of instances have occurred where this state of things has not been long enough continued, to heat a sufficient amount of surface for generating steam beyond what the boiler could resist, or where there was not a sufficient quantity of water thrown at a time upon these heated plates to make enough steam to overcome the powers of resistance of the boiler, but where, most assuredly, an explosion would have followed with but a slight addition of either. All these occurrences tend to weaken the powers of the boilers, and perhaps upon the next occasion they

might yield to a less pressure than that which they had actually resisted before. It will be recollected that these things are passing upon the inside of the boilers, and of course unknown and unseen by the passengers, although the engineer may be well enough apprized of the facts after they have occurred; but it is evidently his interest to conceal them; and as no benefit to him could be derived by its exposition, it need not be expected *he* would do it, but rather content himself by "thanking his stars" that the boilers had withstood the terrible shock.

"As these things are carried on in the dark, we are to look at them in the most rational and common sense manner we can, divest them of all witchcraft or necromancy, treating the subject as we would all others similarly situated, that we may then hope to arrive at safe and proper conclusions as to the causes, and the means best calculated to prevent them.

"It is by introducing and explaining all the facts I can gather, connected in any way with this subject, I hope to convince those who may give me a candid perusal, that there is no *valid excuse* for an explosion of a steam boiler.

"I trust from what has now been said, that it would be a rational conclusion, that if we allow the water to get low in a boiler, the flues to become uncovered, and the fire continued, the flue will become heated upon the upper side, and of course weakened, and as ready to yield to the *pressure* of steam as to the effect of a sledge hammer effectually applied. At the same time it has stowed away within itself a heat which it will certainly give back upon the first application of water; and the larger the amount of heat to be given out, or, in other words, the greater the surface heated, (with a sufficient application of water,) the more dreadful will be the consequences. It is found by actual experiment, that a single cubic foot of iron heated to a red heat, is capable of generating steam enough to fill the largest Mississippi boiler, with a pressure of over five hundred pounds per square inch.

"There is, after all the advantages from the powers of these boilers to resist intense pressures, a serious objection to their use; the flues occupy so large a space of the internal portion of them, that it is difficult to keep over the flue a proper head of water, affording the engineer but little "leeway" in case of accident or want of care, a slight inclination of the boat, from the changing position of the passengers or freight, throwing a bare flue upon the highest side. This is a serious objection; but this kind of boiler has become so generally adopted as the best form for the Western waters, that it will probably remain as it now is; at least, I know of no other form at all likely to supersede it.

"There are instances where water was allowed to get low, and where an explosion (as it were by a miracle) did not occur.

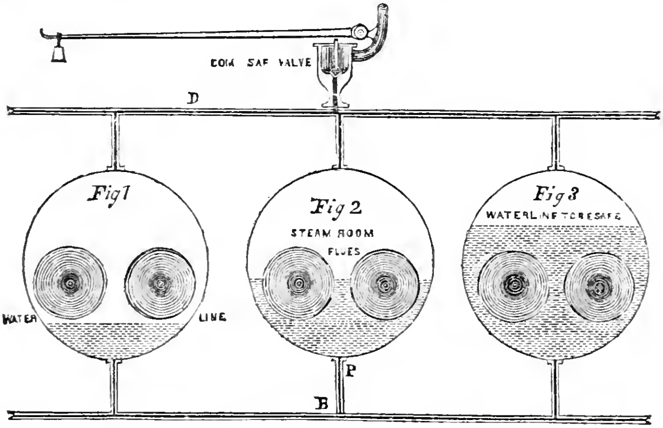
"One instance, authenticated beyond all question, I will here relate. In a steamboat running to the port of Chicago, on a perfectly still day, the water was allowed to get low by some obstruction of the forcing pump, and continued to decrease until every particle of the flues was uncovered; and only seven inches of water on the bottom of the boiler. The flues became heated to a perfectly red heat, and of course the steam, which was generated below them, in coming in contact was heated to a like heat, and in passing through the pipes, set fire to the covering which

surrounded them; even the solder with which they were united, melted and ran off like water.

"For an instant conceive the terrible consequences which would inevitably have followed, had water been suddenly applied to these red hot plates! In this instance, as soon as this state of things was known to exist, the fire was immediately drawn out, and everything cooled down as rapidly as possible; whilst the boat was kept perfectly quiet, and the safety valve not allowed to discharge any steam. As soon as the boilers had been cooled down to a safe point, the forcing pump was examined, and the difficulty corrected, when the boilers were filled up and the boat proceeded on her way."

As to the causes of this condition of things, we know no one who has as yet presented them as clearly and practically as the author before us.

"*What are the Causes of Low Water?*—In the examination of this branch of my subject, I shall find it necessary to take rather a wide scope; for, there are so many causes operating, and "*low water*" has such an important influence in producing the sad consequences more or less attendant upon all steam boiler explosions, that I must necessarily occupy a large space of this treatise in giving a clear understanding of them.



"Plate 2, showing the present Mississippi boilers with what I consider too contracted passages for water and steam; should be increased from 9 inches area say to 27 inches; the pipes changed from cast to wrought iron by all means.

"I have made the drawings, plate 2, figs. 1, 2, and 3. These represent an average number of boilers supposed to be used on each boat now navigating the western waters; these boilers are shown as standing upon and supported by what is termed the "stand-pipe," through which the water is supplied to the boilers; a very great proportion of these are made of *cast* iron, the opening for the passage of the water being only from $2\frac{1}{2}$ to 3 inches in diameter; in many instances the opening does not exceed 2 inches. The stand-pipe marked B, is here purposely represented to show a very small opening, through which it is apparent that all the water must be conveyed to the boiler. Now it is a singular fact, and one, perhaps, which is not generally known, that *cold* water will hold in suspension a

greater proportion of lime than warm or hot; hence, when the temperature of the water is increased, as is generally the case in the heater, before it is sent to the boilers, the lime will be deposited first along the pipe leading to the boiler, and form there a very hard incrustation or deposite, which is very difficult to remove; this deposite will be continued as long as lime is held in suspension in the water by which the boiler is supplied. Oftentimes, in unfavorable localities, these openings will become entirely closed, and the water will of course be entirely cut off. It is this lime held in suspension which gives to water its characteristic which we denominate "hard water;" most all water contains more or less of it.

"I will raise the supposition, that the greatest amount of this deposite does not occur until after the water has passed the second boiler: it will be apparent, as this obstruction is increased, the greater will be the difficulty of water passing to the third boiler than to the second, and so on. Now if water does not readily find its way to the third boiler, of course it will be found *low* there, and probably *high* in one or both the others—showing "*good water*" in these, when in fact it is low in the third. The consequence is, the flue becomes bare and heated, and at the same time weakened, until it is sunk in by the pressure and depressed below the water—producing a rapid increase of steam, and an explosion follows; the engineer asserting, in the most solemn manner, that he had plenty of water, which may be true as regards one and two, but not of the third one.

"It may be that water so full of sediment as is found in the Mississippi, in passing to the boiler, might close this small opening as effectually as it could be done by the incrustation of lime—perhaps by a union of the two causes it would hasten it.

"Instances may occur where persons employed to clean out the boilers have taken in with them an old scrub-broom, a bundle of rags, packing, or some other material for sweeping out the mud and accumulation of sand, and forgetting or neglecting to remove it when they have got through. Suppose this, whatever it may be, settles into and fills up the passage to one of the boilers, or forms a nucleus for checking the dirt in the water, until finally it becomes closed; water then gets low, and the usual effects result. The remedy readily presents itself: *enlarge* the opening of the stand-pipe; and they should always be made of *wrought* iron, and never without an opening of six to eight or ten inches in diameter. There is no possible objection to it. Although explosions may not be brought about very frequently from these causes, yet there are undoubtedly instances where they alone have been the cause, and may do it again. Certainly, prudence alone would dictate an enlargement to guard against it.

"It may be urged that the stage of water in the boiler here described, would be indicated by the "try-cocks" in them. This is very true—it *might* be; but, in many of the boats some of the boilers have no gauge-cocks at all. Besides, an engineer might entirely neglect some one or more of the boilers, if they were furnished with them, and he was constant in his attention to the others; relying upon the hope that if water was good in one, it would be in all. I have, since I commenced the exami-

nation of this subject, passed from Cincinnati to St. Louis on a steamboat where the engineer did not in the whole passage test the water in one of the boilers; I knew the fact by putting upon the stem of the try-cock a little mud, which must have been broken off if it had been tried.

"Although this was a middle boiler, still it should never be neglected, as an obstruction might occur at the upright part marked P, and water pass freely to the last boiler.

"Another cause of want of water, is the inability of the forcing pump to supply, from its want of capacity. If a pump should be found entirely too small to supply the boilers, it would of necessity be laid aside; but in a case where the capacity was just about equal to the demand, or even a little more, when all the valves were in perfect order and working all the time, it would probably be retained, and an effort made to get along with it rather than encounter the additional expense of a new one. Now suppose, for a moment, a pump of this kind, with an engineer of the most undoubted capacity, and noted for his care and prudence, starting his engine with good water in his boilers, and should in a little time find his water going down a very little; he might examine his pump, and remove what he considered the obstruction; he has no means of knowing, without a further trial of his pump, whether it is corrected or not, the pump being hardly sufficient to supply the demand without increasing it; he trusts it in a state of doubt and uncertainty, until it is finally lost in the lower cock. He knows nothing now where the water is, but he knows it is not prudent to go any further; yet, as all on board are anxious to get through, he makes another examination of the pump, and finds a small stick or piece of rag that allowed the water to leak back. The pump is now corrected, and at this moment they run upon a sand bar, or the boat is stopped to take on a passenger. During this time, and no matter how short, the water settles away still lower, and the flues are heating rapidly, until the bell rings to start the engine. Apprehending the dreadful consequences, the engineer complies with the order; the water is set in agitation, overflows the heated flue, a sudden increase of steam is the result, and a struggle between the steam and the boiler follows; the boiler is found the weaker, and gives way: the consequences are too familiar to need a repetition. To make this still more plain, a pump is shown in plate 8, with the obstruction under the valve; and a very small one will answer to produce all the results described.

"The remedy suggested would first be to enlarge the capacity of the pump to double the demand for water in the boiler, and never to run a boat without two of them, that the supply may be continued even though a slight obstruction might occur.

"A great and important remedy is already introduced upon many of the boats, known by the familiar term of "doctor." This is a separate engine connected with the pumps alone, for supplying the water independent of the large engines.

"I conceive this so important an appendage to the safety of steamboats against explosions, that no boat, in my opinion, should be allowed to run a day without one. The value of these engines is now well understood, and they will be likely to be adopted on all new-built boats, whilst the old ones may strive to keep along without them.

"It is well known, however, that steamboats are blown up even when supplied with the best of doctors and the most perfect arrangement of pumps, and some further remedy is required to correct any difficulty that may exist with them.

"I will suppose another case, in which, with a suitable arrangement of pumps, and with the most trustworthy engineer, water may get low, and an explosion occur where it might appear as if the engineer had really been faithful and was not much to blame.

"I will suppose plenty of forcing pumps and a moderate stage of water, the boat running along prudently, the engineer relying upon the known capacity of his pumps to fill up the boilers as rapidly as he may desire; the captain neglects to inform him that he is about to make a landing, but the bell is suddenly rung to stop. Now, it is well known that water will be lost very rapidly when the engine and all are lying still. It wastes away, notwithstanding every thing seems to be perfectly tight and sound. When the boat stopped there was a safe supply, but it begins to diminish; and on inquiry, the captain informs him that he will not be detained but a moment. There is no doctor or any pumps to supply the boiler, that can be worked by hand, and the boat lies in such a position that the large engines cannot well be started; he holds on; water is lost in the lower cock; he begins to feel much alarm, but he expects every instant that the order will come to start, and the deficiency may be made up; during this time the flues become bare and heated, and the dangers of an explosion follow. Had the captain informed him in time, he would have pumped up an additional head before landing, which his pumps would have enabled him to have done.

"These are a few among many instances that may and do often occur, where an engineer may be perfectly competent and careful in the discharge of his duties. Nevertheless, whilst all these dangers are accumulating, the passengers are unapprized of the volcano that slumbers beneath.

"Again, water may get low from *inattention* of the engineer. Supposing he may have a pump with the most ample capacity; it can hardly be expected that water can be fed to the forcing pump so equally, as exactly to meet the supply required by the boilers without any alteration. When the engine is started, we suppose the engineer to go and let on such a supply as he may think is necessary; he waits a little time, and tries the gauge-cocks, and finds he has rather too much water; he diminishes the supply a little, and sits down to await the result; in a short time he tests the water again, and finds, perhaps, that he shut off a little too much; he again adjusts it, and relaxes his vigilance. Perhaps he has been up through the night—is worn out with watching; he sits down and neglects to examine for some time; he feels "*pretty sure*" that the water is being supplied *very near* right, and it is a task to try it so often, and it is deferred until he makes up his mind that it will not do to *risk* it any longer; when, on examination, he finds, to his surprise, that water is gone in the lower cock; he hastens to the supply and turns on all the water, but during all this time a chip has found its way under the valve, or some difficulty has occurred, and instead of getting up rapidly, as he expects, it continues to decrease, and at this juncture the boat makes a landing; and now the

water has a still further decrease by the discontinuance of the agitation, the pump is stopped, and consequences must follow the stage of water within.

"It is undoubtedly the case that, in such instances, the only *safe* course to be adopted is to put down the fires, reduce the temperature and pressure as much as possible, and then fill up with water before running any hazard, and such a course as prudent engineers will adopt; but the question is, will *all* engineers adopt it, knowing it to be so?—evidences are too much against it to indulge the hope.

"Again, instances of the *recklessness* on the part of the engineer, and perhaps other officers of the boat, may be with propriety introduced here. The following, however, may convey enough to show how it may occur, and the passengers, whose safety and lives may be endangered, have no possibility of avoiding it.

"I will suppose a strife between two steamboats: one is attempting to pass the other. The excitement is increased to its highest pitch. The fires are urged to their utmost; the firemen are stimulated to increased exertion. The engineer, too, lends his aid to increase the intensity of the heat; he finds he is increasing his steam, and it begins to escape from the safety-valve; he then loads it with additional weights in the shape of wrenches, hammers, or anything that comes to hand, without knowing, or perhaps caring much, what effect they will have in increasing the pressure of steam. The same things are passing upon the other boat; it is determined "to pass or blow her up;" the forward boat finds that with all the firing that can be done, the other is likely to pass; the engineer goes to the water-gauge, and perhaps finds, thus far, he has kept up a good stage of water. He is in hopes that the other boat will not continue the race but a short distance, or that it is but a short distance when both can part; and if he can by any means hold out until this occurs, he can then unobserved put himself in a safe position. After looking it all over, he concludes he can stand it without *feeding any more water:* at all events, *safe or not safe*, "that boat shall never pass him alive." The other boat has anticipated this movement, and has shut off her water beforehand. This is not altogether a supposed case, but one that has often occurred, and may often occur again.

"The passengers may very justly become alarmed, or, for all that, partake in the excitement; but it cannot be supposed they are made acquainted with the condition of things below; or, if they were, it does not remove a tittle of the danger."

The inefficacy of the "mysterious explanations" is also ably shown, but we have at present no room to extract these remarks.

In reference to the excessive pressure, he remarks that the ascertained pressures vary from 140 to 200 pounds per square inch, but that in many cases there is no means of knowing either, by the engineer himself, what pressure is carried. These statements are still more startling when by reference to a calculation made by Mr. Merrick, jr., in the May number of our *Journal*, page 344, it is shewn from data, sworn to by the builders and engineers of the Western boats themselves, and for other purposes, that owing to the errors in the construction of their engines, in reference to their steam-ports and valves, scarcely more than one-half of this pressure is avail-

able in the cylinders—thus showing how the lives of the passengers are frequently risked without even the poor satisfaction of such pressures being necessary for the desired speed.

We shall probably in a future number, call the attention of our readers again to the extracts from this able pamphlet in reference to the manner in which engines and boats are built and run in the Western waters; for the present, we conclude with the simple remark, that, as was to be expected, this pamphlet, so clearly setting forth the fearful disregard to the safety of life on our waters, appears to have attracted no attention from Congress, and that it seems that we must look for a remedy, not from the laws of the Union or the State, (for the Institute has in vain urged on our Legislature, the necessity of legislating in reference to stationary boilers in our State,) but from some new contrivance, such as the Ericsson engine now in course of construction in New York appears to be.

F.

The Naval Dry Docks of the United States. By Charles B. Stuart, Esq., Engineer in Chief, U. S. Navy. Published by Charles B. Norton, Irving House, New York.

No American work on Engineering has been issued from the press, that will compare with this work in the beauty of its execution, or the intrinsic value of its contents. While the English press has issued book after book, until there is hardly a subject that has not been fully explained, or a public work that has not been illustrated, we have been quietly purchasing their publications, being satisfied that it would not pay to attempt any thing of the kind in this country. This is certainly a melancholy fact, if true. When we reflect that in railroads, water works, gas works, steam ships, sailing ships, dry docks, and bridges, we have works of greater magnitude, built at much less cost, it does appear hard that books fully descriptive of such works, illustrated in a manner commensurate with their importance, cannot be made to pay sufficiently well to justify the expense. This has been the opinion of the past. Mr. Stuart thinks *that time* has gone by, and having been engaged for several years on the stone Dry Dock at New York, the Sectional Docks of Philadelphia and California, and the Balance Docks of Portsmouth and Pensacola, he has concluded to publish a part of his labors, and hence the present work. It is illustrated with twenty-four engravings on steel, made to an accurate scale, so that if measured, each dimension will be found to agree with the description. Every engineer will appreciate the value of such drawings, for, unfortunately, the engravings of many publications in this country and Europe, if judged by this standard, will be found mere pictures. The work also contains the history of each dock, the nature of its foundation, the quantity and kind of material used, the time and cost of its construction, the names of the engineers and contractors, and a great deal of valuable information to those at all interested in the public works of the nation. We trust that Mr. Stuart has not over-estimated the amount of support that his book will receive in this country, and we hope the American people will come forward in a liberal spirit, and sustain a publication so creditable to the country.

B.

INDEX.

LIST OF AMERICAN PATENTS, WITH REMARKS, &c.

A Detaile NNSYLVANIA in the year 1850.

COUNTY.		No. horses and mules employed.	No. Tuyeres.	STACK. Bosh. feet.	STACK. Height. feet.	Kind of Power used.	Kind of Metal made. No.	Capacity. Tons.
Armstrong,	1	48	1	8	30	Steam.	3	1,100
"		20	2	8	32	S.&W.	3	1,100
"		70	2	9	32	Steam.	3	1,900
"		48	1	8	30	Water.	3	1,100
"		52	2	9		"	3	1,400
"		23	1	8		Steam.	3	1,100
"		38	2	8, 6		"	3	1,350
"		80	2	8		"	3	1,610
"		34	1	8		Water.	3	1,100
"		50	1	8	30	"	3	1,100
"		50	2	8, 4	32, 6	Steam.	3	1,430
utler,		28	1	8		Water.	2, 3	1,100
"		29	1	8		"	3	1,100
"		26	1	8		"	3	1,100
"		60	1	9	31	Steam.	2, 3	1,400
"		50	2	9		"	3	1,400
"		70	2	9		"	3	1,400
ambria,	4	38	1	8	30	Water.	3	1,100
"		45	2	8	30	Steam.	3	1,300
"		45	1	8	30	"	3	1,100
"		40	1	8	30	Water.	3	1,100
larion,	28	70	2	9	32	Steam.	3	1,500
"		45						
"								
"								
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Total
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A Detailed Statement of all the CHARCOAL COLD BLAST FURNACES in WESTERN PENNSYLVANIA in the year 1850.

COUNTY.		Date of Sheriff's sale or failure.	No. Furnaces. In Blast.	No. Furnaces. Out Blast.	Date of construction.	NAME OF WORKS.	SITUATION. POST OFFICE.	OWNERS.	Kind of ore used.	Largest Product Tons.	Actual Product 1849. Tons	No of men and boys employed.	No horses and mules employed.	No. Tuyeres.	STACK. Bush. feet	STACK. Height. feet.	Kind of Power used.	Kind of Metal made. No.	Capacity Tons.
Armstrong,	11	1849 S		1	1847	Rock,	Apollo,	A. Woodward,	H. C.	600		60	48	1	8	30	Steam.	3	1,100
"				1	1846	Buffalo,	Worthington,	P. Graff & Co.	C.	300	300	40	20	2	8	32	S & W	3	1,100
"			1		1842	Red Bank,	Red Bank,	Reynolds & Richie,	"	1,900	1,900	100	70	2	9	32	Steam.	3	1,900
"		1850 F		1	1847	Olney,	Kittanning,	McCrea & Galbraith,	"	800	800	60	48	1	8	30	Water.	3	1,100
"			1		1845	Mahoning,	"	J. A. Caldwell & Co.	"	1,300	1,300	83	52	2	9		"	3	1,400
"				1	1830	Alleghany,	"	A. McNickle,	"	600		45	23	1	8		Steam.	3	1,100
"			1		1846	American,	"	Jamison & Ledlie,	"	700	700	57	38	2	8, 6		"	3	1,350
"		1845 F	1		1845	Ore Hill,	"	W. & R. McCutcheon & Co.	"	1,610	1,610	108	80	2	8		"	3	1,610
"		1849 F	1		1845	Cowanshannock,	"	James E. Brown,	"	600	400	36	34	1	8		Water	3	1,100
"		1849 S	1		1846	Phœnix,	Glade Run,	G. B. McFarland,	"	1,040	1,040	75	50	1	8	30	"	3	1,100
"			1		1846	Pine Creek,	Kittanning,	Browns & Mosgrove,	"	1,436	1,436	65	50	2	8, 4	32, 6	Steam.	3	1,430
Butler,	6			1	1848	Marion,	Harrisville,	James Kerr,	"	700	700	40	28	1	8		Water	2, 3	1,100
"		1843 S		1	1828	Slippery Rock,	Slippery Rock,	J. McJunkin,	"	850		47	29	1	8		"	3	1,100
"			1		1840	Hickory,	"	Stewart & Sullivan,	"	850	650	50	26	1	8		"	3	1,100
"			1		1843	Maple,	Maple Furnace,	H. Graff.	H. C.	1,000	1,000	80	60	1	9	31	Steam.	2, 3	1,400
"			1		1847	Kensington,	Lawrenceburg,	A. W. Crawford & Co.	C.	900	600	80	50	2	9		"	3	1,400
"			1		1848	Winfield,	Butler,	W. L. Spear,	"	1,400	1,400	100	70	2	9		"	3	1,400
Cambria,	4		1		1845	Mill Creek,	Johnstown,	J. Bell & Co.	H.	1,050	840	80	38	1	8	30	Water	3	1,100
"			1		1842	Cambria,	"	King & Schoenberger,	"	1,300	820	90	45	2	8	30	Steam.	3	1,300
"			1		1846	Mount Vernon,	"	Linton, Galbraith & Co.	"	1,000	1,000	90	45	1	8	30	"	3	1,100
"				1	1847	Ashland,	Summit,	Hugh McNeil,	C.	800	800	80	40	1	8	30	Water	3	1,100
Clarion,	28		1		1845	Helen,	Clarion,	W. S. Packer & Co.	"	1,500	1,000	100	70	2	9	32	Steam.	3	1,500
"				1	1828	Clarion,	"	C. Meyers,	"	1,400	600	70	45	1	9	32	Water	3	1,400
"				1	1845	Martha,	"	"	"	1,100	600	70	45	2	9	32	Steam.	3	1,400
"			1		1844	Mary Ann,	Shippenville,	J. Black & Co.	"	700	450	50	30	1	8	30	Water	3	1,100
"			1		1832	Shippenville,	"	Shippen & Black,	"	1,200	1,200	70	50	1	8, 6	32	"	2, 3	1,350
"			1		1844	Tippecanoe,	"	King & Maxwell,	"	1,000	800	65	46	1	8	32	S & W	3	1,100
"			1		1841	Prospect,	Callansburg,	Alexander & McIlroy,	"	700	700	60	41	1	7, 6		"	3	1,000
"			1		1842	Elk,	Shippenville,	W. B. Fetzer,	"	800	500	60	34	1	7, 6		Water	3	1,000
"			1		1841	St. Charles,	Leatherwood,	Patrick Kerr,	"	1,000	800	81	48	2	9		S & W	2, 3	1,400
"		1850 S		1	1841	Deer Creek,	Shippenville,	James Hasson,	"	900	100	66	36	1	8		Water	3	1,100
"		1849 S		1	1844	Black Fox,	Brady's Bend,	Adams & Vernon,	"	950	950	66	40	1	8, 6		Steam.	3	1,350
"			1		1841	Clinton,	Clinton Furnace,	Moore & Seymour,	"	650	500	56	36	1	8		Water	3	1,100
"			1		1845	Licking,	Licking,	Sigworth & Fetzer,	"	550	400	52	35	1	7, 6		"	3	1,000
"			1		1845	Monroe,	Clarion,	C. Fulton,	"	900	700	72	38	1	8		"	2, 3	1,100
"		1850 S		1	1845	Limestone,	Greenville,	J. & J. B. Lyons,	"	700	316	58	33	1	8		"	3	1,100
"			1		1838	Jefferson,	Jefferson Furnace,	S. F. Plummer,	"	1,200	1,200	83	58	2	9		W & S	3	1,400
"			1		1842	Buchanan,	Callansburg,	Plummer & Creary,	"	1,200	830	86	61	2	9		Steam.	3	1,400
"			1		1845	Pike,	Curlsville,	Lawson, Duff & Orr,	"	1,000	830	77	53	1	8, 6		"	3	1,350
"			1		1846	Eagle,	Callansburg,	Reynolds & Cribbs,	"	850	850	58	47	1	8		"	3	1,100
"		1849 S	1		1846	Catfish,	Brady's Bend,	Miller & Son,	"	1,120	1,120	75	48	1	9		"	3	1,400
"			1		1845	Sligo,	Clarion,	Lyon, Shorb & Co.	C. H.	1,555	1,215	75	40	1	8, 6	35	"	3	1,560
"			1		1836	Madison,	"	"	"	1,565	1,421	75	40	1	8, 6	35	S & W	3	1,560
"			1		1835	Beaver,	Shippenville,	Miller & Long,	C.	1,210	1,050	92	73	1	9		Steam.	3	1,400
"			1		1846	Washington,	Clarion,	Long, Carothers & Co.	"	1,420	1,420	105	84	2	9		"	3	1,420
"		1849 F	1		1847	Mount Pleasant,	Strattonville,	Brown, Phillips & Co.	"	830	830	62	45	1	8, 6		"	3	1,350
"			1		1845	Hemlock,	Clinton,	Horner & Eaton,	"	986	986	69	43	1	8, 6		S & W	3	1,350
"		1849 S		1	1843	Franklin,	Reimersburg,	J. Thompson & Co.	"	1,025	912	67	50	1	8		Steam.	3	1,100
"			1		1846	Richland,	Emlington,	John Keating,	"	1,060	1,060	70	56	1	9		"	3	1,400
Erie,	1			1	1842	Erie,	Erie,	Vincent, Himrod & Co.	B.	900	300	50	50	1	7	30	Water	1, 2	900
Fayette,	5		1		1796	Fair Chance,	Uniontown,	F. H. Oliphant & Son,	C.	800	600	48	25	1	9	36	S & W	2, 3	1,400
"		1847 F	1		1820	Cool Spring,*	"	McKean and others,	"	300	200	30	15	1	7	33	Water	3	900
"		1848 F		1	1835	Wharton,	"	A. Stewart,	"	1,000		60	42	1	8	33	S & W.	2, 3	1,100
"		1849 F		1	1805	Spring Hill,	Spring Hill,	J. K. Duncan,	"	600	400	50	28	1	8	33	"	2, 3	1,100
"		1849 F	1		1796	Union,	Connelsville,	S. Shoyer,	"	600	320	55	28	1	8	33	Water	2, 3	1,100
Indiana,	2	1849 S		1	1847	Buena Vista,	Armagh,	McClelland & Co.	"	400		61	30	1	8	30	"	3	1,100
"		1848 S		1	1847	Loop,	Smixburg,	Hampton & Smith,	"	200		50	25	2	9	33	"	3	1,400
Lawrence,	1			1	1844	Martha,	New Castle,	Power & Sons,	"	600	200	75	30	2	8	36	"	2, 3	1,100
Mercer,	3			1	1837	Springfield,	Leesburg,	P. Sennett & Co.	"	500	300	41	20	2	7	32	"	1, 2	900
"		1850 S		1	1845	Oregon,	Mercer,	Lyon, Mix & Co.	"	300		50	25	2	8, 6	37	Steam.	3	1,358
"				1	1846	Iron City,	"	W. W. Wallace,	"	600	600	75	40	2	8, 6	34	"	2, 3	1,350
Somerset,	2	1849 S		1	1847	Somerset,	Johnstown,	Huber & Myers,	C. H.	900	300	80	50	1	8, 6	30	Water	3	1,350
"		1847 F		1	1844	Rock,	Stoystown,	Kuster & Little,	C.	300		43	15	1	6	21	"	2	700
Venango,	18	1849 F		1	1843	Bullion Run,	Franklin,	McKee & Harris,	"	760		58	38	1	8		"	3	1,100
"		1850 S		1	1830	Venango,	Phipps' Mills,	A. Phipps,	"	1,200	250	70	50	1	8		"	3	1,200
"		1846 S		1	1843	Annandale,	Hendersonville,	Gen. C. Read,	"	800	200	53	46	1	8		Steam.	3	1,100
"			1		1847	President,	President Furnace,	E. E. Clapp & Co.	"	509	509	50	25	1	8		Water	2, 3	1,100
"			1		1835	Mill Creek,	Mill Creek,	Charles Shippen,	"	910	550	62	46	1	7, 6		"	3	1,000
"			1		1832	Van Buren,	Franklin,	James Eaton,	C. B.	920	700	57	50	1	7, 6		"	3	1,000
"			1		1832	Clay,	"	Edmund Evans,	C.	800	500	50	35	1	8		"	3	1,100
"		1850 S	1		1834	Slab,	"	James Hughes,	"	700	400	50	30	1	8, 6	30	"	3	1,350
"		1850 S		1	1844	Victoria,	"	Alexander Hays,	"	700	200	46	33	1	8, 6		"	3	1,350
"		1848 S		1	1844	North Bend,	"	Hoover & Rens,	"	450		30	25	1	8, 6		"	3	1,350
"		1850 S		1	1844	Union,	"	Guest, Williams & Co.	"	600	150	42	31	1	8		"	3	1,100
"		1848 S		1	1844	Texas,	"	A. W. Porter,	"	500		36	30	1	8, 6		"	3	1,350
"		1847 S		1	1842	Liberty,	Sugar Creek,	E. Reynolds & Co.	"	500	200	60	50	1	8	30	Steam.	3	1,100
"				1	1843	Reymilton,	Franklin,	A. W. Raymond,	"	1,000	450	60	60	1	8	30	Water	3	1,100
"			1		1839	Webster,†	Rockland,	Dempsey & Wick,	"	800	500	65	58	1	8, 6	30	W & S	3	1,350
"		1848 S	1		1836	Sandy,	Franklin,	Painter & Co.	"	653	653	53	32	1	8		Water	3	1,100
"			1		1838	Jane,	Clintonville,	W. Cross & Co.	"	785	480	57	38	1	8		"	3	1,100
"		1850 S		1	1835	Jackson,	Cass,	N. B. & D. P. Hatch,	"	730	310	60	36	1	8, 6		"	3	1,350
Westmoreland,	4		1		1815	Ross,	West Fairfield,	J. D. Mathiott & Co.	F.	750	500	30	40	1	8	30	"	1, 2	1,100
"			1		1809	Washington,‡	Laughlintown,	J. Bell,	"	560	560	40	30	1	9	33	"	2, 3	1,400
"		1849 S		1	1847	Ramsey,	Kiskiminitis,	Dr. Spear,	H.	90		50	20	1	9	34	"	3	1,400
"		1848 S		1	1846	Lockport,	Lockport,	W. McKierney,	"	400		50	25	1	8	33	"	3	1,100
No. furnaces sold by Sheriff or failed,		34																	
No furnaces in blast,			49																
No. furnaces out blast,				35															
Total No. Furnaces,					84					72,924	50,968	5,353	3,520						104,130

* Leased by F. H. Oliphant and Son. † Leased by S. Dempsey. ‡ Abandoned 1826, Rebuilt 1848.

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A Detailed Statement of all the ROLLING MILLS IN EASTERN PENNSYLVANIA, in the year 1850.

...NTY	Sold by Sheriff, or failed.	Date of construction.	NAME OF WORKS.	SITUATION. POST OFFICE.	OWNERS.	No. Puddling Fur.	No. Heating Fur.	No. Train Rolls.	No. Nail Machines.	CONSUMED. Bituminous Coal. Bush.	Anthracite Coal. Tons.	Pig. Tons.	Bloom. Tons.	Scrap Tons.	Largest Product. Tons.	No Furnaces running, 1850. Puddling	Heating.	No. of men and boys employed	No. oxen, horses and mules employed.	Description of Iron made.	Kind of Power used.	Actual make, 1849. Tons.	No. ran out fires.	Market.
. . .		1845	Bertolet's,	Reading,	M. A. & S. Bertolet & Co.	4	4	2			4,000	1,800	150	50	1,500	2	2	60	2	Sheets, Bars, Rods,	Steam.	500		E.
		1836	Reading,	"	Reading Iron and Nail Co.	12	3	3	30		14,000	5,000	200	100	4,275	6	3	155	3	Bar, Rods, Nails, Band and Hoop,	"	2,100		"
		1848	Birdsboro,	Birdsboro,	E. & G. Brooke,	4	2	1	16		3,000	1,200	100	100	1,000	4	1	100	4	Nails,	Water.	1,000		"
		1846	Gibraltar,	Robeson Township,	H. A. Seyfert, McIlvaine & Co.		2	1			900		600		600		1	10	4	Boiler,	"	400		"
		1845	Pine,	Douglasville,	Joseph Bailey,		2	1		25,000			850		850		2	18	6	"	"	850		"
.		1839	Portage,	Duncanville,	Royer, McNeal & Co.	4	4	3	18	115,000		1,700	100	50	1,500	4	2	50	18	Nails, Plate, Bar and Rod,	Steam.	1,000	1	E. & W.
.		1825	Bellefonte,	Bellefonte,	Valentines & Thomas,	1	2	3		25,000		500	600		1,000	1	1	16	18	Slit Rods, Bars and Axles,	Water	1,000		E.
		1831	Milesburg,	Milesburg,	Irvin, McCoy & Co.	1	2	1		37,500		500		20	1,000	1	1	30	26	Slit Rods, Bar, Wire-Billets,	"	800		"
	1849 S	1846	Hecla,	Zion,	Boyd & Cummings,	2	1	1		20,000		500			400			16	12	Plate and Sheet,	Steam.			"
	1843 F	1829	Eagle,	Milesburg,	C. & J. Curtin,	1	1	1		17,500		500			750	1	1	10	6	Wire-Billet and Shovel Plate,	Water.	546		"
		1840	Howard,	Howard,	Irvin, Thomas & Co.	3	1	1		30,000		1,250			1,000	3	1	18	3	Slit Rods and Bars,	"	400		"
...er, .		1838	Triadelphia,	Coatesville,	James Yearsley & Bro.	1	4	2		30,000		150	450	20	550	1	2	20	4	Boiler and Flue Iron,	"	550		"
		1844	Pine Grove,	Oakhill,	Enos Pennock,		2	1		12,000			400		400		1	9	4	" "	"	340		"
	1848 S	1845	Pleasant Garden,	N. London ✕ Roads,	Ellis P. Irwin,	1	2	1		18,000			600		600			16	4	" "	"			"
		1849	Summerfield,	Pottstown,	Christman & Bro.		2	1										10	10	" "	S &W.			"
		1830	Chester Co.	Phœnixville,	Jaudons & Mason,	7	2	1	40		4,000	2,200	100	100	2,000	7	2	70	2	Nails,	Water.	1,800		"
		1836	W. Brandywine,	Coatesville,	S. Hatfield,		4	2		30,000			1,000		1,000		4	30	14	Boiler and Flue,	"	1,000		"
		first built 1790 rebuilt 1835	Phœnix,	Phœnixville,	Reeves, Buck & Co.	15	4	4			6,988	5,785			5,251			130	15	Bar and Sheet,	S.&W.			"
		1846	Phœnix Rail Mill,	"	"	25	6	2			20,656	12,105			9,442	13	3	307		R. R. Iron,	Steam.	5,463		"
		1837	Hibernia,	Wagontown,	Charles Brooke,		2	1		14,000	20		400		450		1	16		Boiler and Flue,	Water.			"
		1810	Brandywine,	Coatesville,	Mrs. R. W. Lukens,‡		2	1		21,000	50		944		944		2	17	4	" "	"	944		"
		1825	Laurel,	"	Hugh E. Steel,§	1	2	1		20,000	50		854		854		2	18	10	" "	"	854		"
		1847	Thorndale,	Downingtown,	J. & J. Forsythe & Sons,	2	4	1		35,000		200	725		725	1	4	32		" "	Steam.	725		"
	1849 F	1795	Rokeby,	Coatesville,	Mrs. A. Fisler,		3	1		50,000	50		875		875			22	10	" "	Water.	150		"
		1840	Caln,	"	Pennock's Heirs,	2	3	2		50,000	50	800	800		Angle 600 Boiler 800			42	4	" and Rod,	"			"
...bia, . :		1846	Montour,	Danville,	Montour Iron Co.	30	8	2			19,466	9,807			7,357	30	8	250	8	Rails,	Steam.	1,943		"
		1847	Rough and Ready,	"	Hancock & Foley,	4	2	2		2,000	3,000	1,050		50	955	4	2	62	2	Bar, Rod,	"	955		"
	1848 S	1845	Danville,	"	S. P. Case, (Davis, lessee,)	3		2			1,081	803			725			28	1	Pud. Bar,	"			H.
...erland,‖ .		1831	Fairview,	Harrisburg,	J. Pratt & Son,	5	3	3	36	90,000		1,800	50		1,500	5	3	75	30	Bar, Rod, Nails,	Water.	1,500		E. & H.
...hin, . .	1842 S	1836	Harrisburg,	Harrisburg.	J. Pratt & Son,		2	1		13,000	500		400	25	400		2	14	1	Boiler,	Steam.	400		E.
...ware, . .		1808	Franklin,	Chester,	J. G. Johnson,		1	1			300		10		220		1	7	5	Spring Steel, 210, Sheet Iron, 10,	Water.	220		"
...klin, . .	1842 F	1810	Montalto,	Montalto,	H. & H. Hughes,		4	2		5,000				40	340		4	150	30	Bar and Rods,	"	340	1	H.
...ngdon, .	1850 S	1847	Juniata,	Shaver's Creek,	Ed. F. Schoenberger,	1	3	1		15,000		200			150			19	1	Boiler, Sheet,	"	100	1	W.
do.		1838	"	Alexandria,	S. Hatfield & Son,	2	3	2		55,000		660			1,000	2	3	45	22	Boiler, Sheet, Bar,	"	1,000	1	E. H. W.
...aster, .		1848	Safe Harbor,	Safe Harbor,	Reeves, Abbott & Co.	24	6	2		175,000	5,996	7,805			5,567	16	4	375	20	Rails,	Steam.	5,567		E.
do.		1828	Colemanville,	Lancaster,	R. & G. D. Coleman,		4	2	12		1,000		1,059		1,500		4	50	21	Boiler and Flue, Bar and Slit Rod, Steel,	Water.	237 871 106		" E. & H. E.
...rne, . .	1848 S	1842	Wyoming,	Wilkesbarre,	T. T. Paine,	12	10	5	20		6,500	3,800			3,000			250	10	Rails, Bar, Nails,	Steam.			"
...n.		1844	Lackawanna,	Scrantonia,	Scranton & Platt,	24	7	4	22		14,000	10,000			7,000	16	6	250	75	Rails,	S.&W.	6,000		"
...ming, . .		1842	Heshbon,	Newberry,	Wm. McKinney,	1	1	1		17,500		125	300		400	1	1	7	2	Bars,	Water.	350		E. & H.
do.		1842	Crescent,	Trout Run,	C. G. Heilman & Bros.	2	1	2	7	30,000		350		20	300	1	1	20	6	Bars and Nails,	"	300		H.
...tgomery,¶ .		1846	Pottsgrove,	Pottstown,	Henry Potts & Co.	3	4	2			3,000	400	863		1,500	1	2	30	14	Boiler and Rods,	Steam.	Boiler, 863		E.
do.		1846	Norristown,	Norristown,	Moore & Hooven,	10	3	3			6,100	3,250	50	150	2,775	10	3	125	3	Bars, Band and Nail Plates,	"	1,775 1,000		" "
do.		1830	Conshohocken,	Conshohocken,	Jas. Wood & Sons,	2	2	2			1,200	600	200		350	1	1	22	1	Imitation Russian Sheet,	Water.	279		"
do.		1790	Cheltenham,	Philadelphia,	Mrs. H. M. Rowland,**		3	1		25,000			600		600		1	25	14	Boiler and Flue,	"	300		"
...thampton, .		1837	Lehigh,	S. Easton,	Rodenbaugh, Stewart & Co.		4	3	6		1,500		1,000	50	Wire 1,050		2	65		Wire,	"	900		"
...ladelphia, .		1845	Kensington,	Kensington,	Jas. Rowland & Co.	10	3	3			5,000	2,500	250	250	2,500	10	3	75	4	Bars, Rods,	Steam.	2,500		"
do.		1840	"	"	Jos. Jobson & Co.		2	2			500		1,300		1,200		1	8	2	Saw Plates, Spring Steel,	"	600		"
do.		1845	Penn,	"	Robbins & Verree,		4	2			1,250		200	1,800	2,517		2	28	4	Bars, Boiler, Slit Rod, Spring Steel,	"	1,685		"
do.		1846	Treaty,	"	Leiberts & Wainwright,	5	3	2			3,000	1,750			1,400			75	2	Bars, Rails,	"			"
do.	1848 F	1846	Fairmount,	Spring Garden,	Thomas & Ogden,	7	2	3			7,000	3,416	787	180	3,876			105	4	Bar, Rod, Band,	"			"
do.		1848	Fountain Green,	"	Jas. S. Spencer,	2	2	2		7,000	300	350		50	300			20	6	Rod, Spikes,	"	300		"
do.	1842 S	1820	Flat Rock,	Manayunk,	M. B. Buckley & Son,	1	2	2		12,000	750	225	450		600	1	1	18	4	Boiler and Flue,	Water.	600		"
do.		1842	Oxford,	Frankford,	W. & H. Rowland,		2	1		10,000	1,000		400	400	700		2	10	4	Spring and Saw Steel,	Steam.	600		"
Perry,†† . .		1838	Duncannon,	Duncannon,	Fisher, Morgan & Co.	10	5	5	45	120,000	3,000	4,000	50	300	3,000	10	3	200	25	Bar, Plate, Rod,	Water.	2,975		E. & H.
Tioga, . .		Unfinished.	Blossburg,	Blossburg,	J. H. Gulick,	1	1	1												Bars,	Steam.			H.
Schuylkill,‡‡ .	1844 S	1839	Franklin,	Port Clinton,	John Raush,	2	1	1			1,500	440	-	150	450	1	1	18	7	Bars,	Water.	50		E. & H.
	12					247	164	106	252	1,126,500	140,707	87,521	17,717	3,905	91,598	153	97	3,648	511			54,738	4	

Schall & Dewees, Norristown, 24

Total No. Nail Machines in Eastern Pennsylvania, 276

* No bars made last year nor this year. † No bars made for market since June, 1848, now making nails and gas tubes only. ‡ Gibbons & Huston, lessees. § Steel & Worth, lessees. ‖ Have sold no bars in the city since 1847.
¶ Made no bar iron since January, 1848. ** Rowland & Hunt, lessees. †† Have sold no bars or rods in the city since November, 1848. ‡‡ No bars made for city market since 1847.

tal inm the Land and Buildings
1850.

NTY.	OLD stment.	RGES. Investment	ROLLING MILLS. S.* F.	Total No.	Investment.	TOTAL. S.* F.	Total No.	Investment.	Counties.
eny,				16	1,837,000		16	1,837,000	1.
rong,	74,560		1	2	175,000	11	18	1,387,560	2.
r,									3.
,	90,000					1	6	190,000	4.
ria,	45,000					1	6	222,000	5.
n,	77,166	4,000				7	30	1,221,166	6.
ford,									7.
									8.
	12,000						1	12,000	9.
	51,500		1	2	115,000	5	7	266,500	10.
tte,									11.
st,									12.
ne,	18,000	5,000				4	5	138,000	13.
na,									14.
rson,	20,000			2	250,000		4	310,000	15.
rence,									16.
Kean,	68,000					7	16	471,000	17.
cer,	35,000	5,000				4	4	60,000	18.
nerset,	37,650			1	48,500	12	21	576,150	19.
nango,									20.
rren,									21.
shington,									
estmoreland,	05,000					3	6	196,000	22.
	13,876	14,000	2	23	2,425,500	55	140	6,887,376	

22 Counties-

6. Tio											
7. Union,		0			0						
8. Wayne,		0			0				0		39.
9. Wyomin	1	3	90,000		0			3	8	368,000	40.
0. York,											
	36	118	2,012,300	12	56	3,128,700	120	364		13,614,700	

* Sold by t
† On 2 of t
ke the place

The remaining furnace will be completed and blown in, as it is to

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STATEMENT, showing the number and condition of each sort of IRON WORKS, and the capital invested in the Land and Buildings in each County in WESTERN PENNSYLVANIA, in the year 1850.

…UNTY.	FURNACES. RAW BITUMINOUS COAL AND HOT BLAST S.* F.	In.	Out.	Total.	Investment.	COKE AND HOT BLAST. S.* F.	In.	Out.	Total.	Investment.	CHARCOAL AND HOT BLAST. S.* F.	In.	Out.	Total.	Investment.	CHARCOAL AND COLD BLAST. S.* F.	In.	Out.	Total.	Investment.	FORGES. S.* F.	Total No.	Investment	ROLLING MILLS. S.* F.	Total No.	Investment.	TOTAL. S.* F.	Total No.	Investment.	Counties.
…gheny,																									16	1,837,000		16	1,837,000	1.
…strong,						4	0	4	4	800,000	1	1		1	38,000	5	7	4	11	374,560				1	2	175,000	11	18	1,387,560	2.
…ver.																														3.
…er,																1	4	2	6	190,000							1	6	190,000	4.
…bria,											1	1	1	2	77,000		3	1	4	145,000							1	6	222,000	5.
…ion,											1	1		1	40,000	6	22	6	28	1,177,166		1	4,000				7	30	1,221,166	6.
…wford,																														7.
																														8.
																		1	1	12,000								1	12,000	9.
…ne,																4	3	2	5	151,500				1	2	115,000	5	7	266,500	10.
…er.																														11.
…ne,																														12.
…na,											1	2		2	85,000	2		2	2	48,000	1	1	5,000				4	5	138,000	13.
…non,																														14.
…ence,												1		1	40,000			1	1	20,000					2	250,000		4	310,000	15.
…ean,																														16.
…er,	3	3	4	7	223,000						3	1	5	6	180,000	1		3	3	68,000							7	16	471,000	17.
…erset,											1		1	1	20,000	2		2	2	35,000	1	1	5,000				4	4	60,000	18.
…ango,											1	1	1	2	40,000	11	8	10	18	487,650					1	48,500	12	21	576,150	19.
…ren,																														20.
…hington,																														21.
…moreland,											1	2		2	91,000	2	2	2	4	105,000							3	6	196,000	22.
	3	3	4	7	223,000	4	0	4	4	800,000	10	10	8	18	611,000	34	49	36	85	2,813,876	2	3	14,000	2	23	2,425,500	55	140	6,887,376	

…2 Counties—13 Counties having Iron Works.

* Sold by Sheriff or failed since 1840.

nsylvania, in the year 1850.

STATING Land and Buildings in

NSYLVANIA in the year 1850.

	Diam. Bosh. feet.	Height feet.	Kind of Power used.	Kind metal and No.	Capacity. Tons.	Remarks.
Arms	9	32	W.&	3	1,800	
Cam	9	30	Water,	2, 3	1,800	
"	9	30	"	3	1,800	
Clari	7, 10	30	"	1, 2	1,450	Leased by Reynolds & Evans.
India	9	30	"	2, 3	1,800	Bosh 7 feet until 1847.
"	8	30	"	2, 3	1,400	
Lawr	10	34	Steam,	2, 3	2,000	
Merc	10	38	"	1, 2	2,000	
"	9	40	"	2, 3	1,800	Leased by Whitaker & Watson.
"	8, 6	34	"	2, 3	1,600	
"	8		Water,	3	1,400	
"	7		"	3	1,000	
"	7, 6	33	Steam,	2, 3	1,000	
Some	8	30	Water,	2, 3	1,400	Abandoned 1828, rebuilt 1846.
Vena	9	27, 6	"	2, 3	1,800	
"	8, 6	28	Steam,	2	1,600	Leased by J. Dempsey.
West	9	33	"	3	1,800	
	9	33	Water,	3	1,800	
					29,230	

								0		34.
5. Schuylki	4	6	127,000	1	1	20,000	6	12	254,500	35.
6. Tioga,		0			1	5,000	1	2	25,000	36.
7. Union,	1	1	6,000		0		3	4	37,000	37.
8. Wayne,		0			0			0		38.
9. Wyomin		0			0			0		39.
0. York,	1	3	90,000		0		3	8	368,000	40.
	36	118	2,012,300	12	56	3,128,700	120	364	13,614,700	

* Sold by t

† On 2 of t

ke the place

The remaining furnace will be completed and blown in, as it is to

, Bog Ore.

A Detailed Statement of all the CHARCOAL HOT-BLAST FURNACES IN WESTERN PENNSYLVANIA in the year 1850.

COUNTY.	Date of Sheriff's sale or failure.	No. furnaces. In.	No. furnaces. Out.	Date of construction	NAME OF WORKS.	SITUATION. POST OFFICE.	OWNERS.	Kind of ore used.	Largest Product. Tons.	Actual make 1849. Tons.	No. men and boys employed.	No. horses and mules employed	No. tuyeres	Diam. Bosh. feet.	Height feet.	Kind of Power used.	Kind metal and No.	Capacity. Tons.	Remarks.
Armstrong, 1	1844 S	1		1839	Buffalo,	Worthington,	P. Graff & Co.,	C.	1,800	1,800	80	50	2	9	32	W.& .	3	1,800	
Cambria, 2		1		1846	Ben's Creek,	Johnstown,	G. S. King & Co.,	H.	1,080	1,080	90	35	2	9	30	Water,	2, 3	1,800	
"	1848 S		1	1846	Eliza,	Ebensburg,	Ritter & Irvin,	H.	1,000		90	45	2	9	30	"	3	1,800	
Clarion, 1	1842 S	1		1833	Lucinda,	Lucinda,	Reynolds & Buchanan,	C.	1,429	1,280	80	45	1	7, 10	30	"	1, 2	1,450	Leased by Reynolds & Evans.
Indiana, 2	1845 S	1		1842	Indiana,	Armagh,	Elias Baker,	H.	1,100	900	80	36	2	9	30	"	2, 3	1,800	Bosh 7 feet until 1847.
"		1		1846	Blacklick,	"	Schoenberger, King & Co.,	"	1,000	756	80	46	1	8	30	"	2, 3	1,400	
Lawrence, 1		1		1848	Wilmington,	Wilmington,	Cassallo Iron Co.,	C.	1,400	1,400	100	50	3	10	34	Steam,	2, 3	2,000	
Mercer, 6	1848 F		1	1846	Hamburg,	Delaware Grove,	John Warden,	"	800	800	75	30	2	10	38	"	1, 2	2,000	
"	1848 F		1	1848	Harry of the West,	Georgetown,	Dr. Wm. Irvin,	"	500	500	80	50	3	9	40	"	2, 3	1,800	Leased by Whitaker & Watson.
"		1		1846	Mineral Ridge,	"	Ward & Co.,	"	900	400	75	33	2	8, 6	34	"	2, 3	1,600	
"			1	1846	Sandy No. 2,	Pryon,	Gen. C. M. Read,	"	600		50	30	2	8		Water,	3	1,400	
"			1	1838	" " 1,	"	"	"	500		50	30	2	7		"	3	1,000	
"	1849 S		1	1846	Mazeppa,	Mercer,	J. P. Garrett & Co.,	"	800		60	35	2	7, 6	33	Steam,	2, 3	1,000	
Somerset, 1	1850 S		1	1812	Shade,	Stoystown,	Shryock, Bingham & Co.,	C. H.	900	750	80	43	1	8	30	Water,	2, 3	1,400	Abandoned 1828, rebuilt 1846.
Venango, 2	1847 S		1	1845	Orleans,	Franklin,	Reymond & Grey,	C.	700	700	50	45	3	9	27, 6	"	2, 3	1,800	
"		1		1832	Rockland,	Rockland,	Dempsey & Wick,	"	550	200	50	40	1	8, 6	28	Steam,	2	1,600	Leased by J. Dempsey.
Westmoreland, 2		1		1847	Conemaugh,	Armagh,	McGill & Foster,	H.	800	600	60	30	2	9	33	"	3	1,800	
"	1848 S	1		1846	Laurel Hill,	West Fairfield,	Hoover & McCallister,	"	800	800	80	40	2	9	33	Water,	3	1,800	
	10	10	8						16,659	11,966	1,310	713						29,230	

Total number furnaces 18

nsylvania, in the year 1850.

STATING Land and Buildings in each C...

NSYLVANIA, in the year 1850.

...and em-...ed.	No. oxen, Horses, and mules employed.	BLAST. Tuyeres No.	BLAST. Tuyeres Diam.	Pres-sure	STACK. Bosh. feet.	STACK. Height. feet.	Kind of Power used.	Kind of metal made and No.	Capacity.
)	30	2	3		10	37	Steam.	1, 2	2,000
	20	3	3		10	40	Steam.	2, 3	2,000
Merce	30	2	3	2	8½	37	"	2, 3	1,600
"	25	2	3	2	8	36	W. & S.	2, 3	1,500
"	40	2	3		10	55	Steam.	3	2,000
"	50	3	3		10	50	"	3	2,000
"	25	3	3		8	40	"	3	1,500
"									
	220								

NSYLVANIA in the year 1850.

C...	...o. oxen, Horses, ...les employed.	BLAST. Tuyeres. No.	BLAST. Tuyeres. Diam.	STACK. Bosh. feet.	STACK. Height. feet.	Kind of Power used and No	Kind of metal made and No.	Capacity.
		3	2½a3	11	40	Steam.	2, 3	2,000
rmstro	100	3	"	11	40	"	"	2,000
"		3	"	13	50	"	"	3,500
"			"	14	50	"	"	4,500
"								12,000

									0		34.
5. Schuylki	4	6	127,000	1	1	20,000	6	12	254,500	35.
6. Tioga,		0			1	5,000	1	2	25,000	36.
7. Union,	1	1	6,000		0		3	4	37,000	37.
8. Wayne,		0			0			0		38.
9. Wyomin		0			0			0		39.
0. York,	1	3	90,000		0		3	8	368,000	40.
	36	118	2,012,300	12	56	3,128,700	120	364	13,614,700	

* Sold by t

† On 2 of t

ke the place

The remaining furnace will be completed and blown in, as it is to

, Bog Ore.

A Detailed Statement of all the RAW BITUMINOUS COAL HOT-BLAST FURNACES IN PENNSYLVANIA, in the year 1850.

COUNTY.	Date of Sheriff's sale or failure.	No. Furnaces. In Blast.	No. Furnaces. Out of Blast.	Date of construction.	NAME OF WORKS.	SITUATION. P. O.	OWNERS.	LESSEES.	Kind of ore used.	Largest Product. Tons.	Actual make 1849, Tons.	No. Men and boys employed.	No. oxen, Horses, and mules employed.	BLAST. Tuyeres No.	BLAST. Tuyeres Diam.	BLAST. Pressure	STACK. Bosh. feet.	STACK. Height. feet.	Kind of Power used.	Kind of metal made and No.	Capacity.
Mercer,			1	1845	Middlesex,	Middlesex,	Sennett, Lester & Co.,	None.	C.	1,400	1,000	80	30	2	3		10	37	Steam.	1, 2	2,000
"		1		1846	Sharon,	Sharon,	Schoenburger, Agnew & Co.,	"	C.	1,750	1,750	80	20	3	3		10	40	Steam.	2, 3	2,000
"		1		1845	Clay,	Clarksville,	Himrod, Vincent & Co.,	"	C.	1,150	1,150	75	30	2	3	2	8½	37	"	2, 3	1,600
"		1		1845	Shenango,	Mercer,	McFarland & King,	"	C.	1,000	1,000	60	25	2	3	2	8	36	W. & S.	2, 3	1,500
"	1848 F		1	1846	Harriet,	Greenville,	Dr. Wm. Irvin,	"	C.	800		80	40	2	3		10	55	Steam.	3	2,000
"	1848 F		1	1846	Mary Ann,	do.	do.	Whitaker & Watson.	C.	1,200		80	50	3	3		10	50	"	3	2,000
"	1848 F		1	1847	Blanche,	Sharon,	McClure & Co.,	None.	C.	500		60	25	3	3		8	40	"	3	1,500
	3	3	4							7,800	4,900	515	220								

A Detailed Statement of all the COKE HOT-BLAST FURNACES IN THE STATE OF PENNSYLVANIA in the year 1850.

COUNTY.	Sold by Sheriff, or failed.	No. Furnaces. In Blast	No. Furnaces. Out of Blast.	Date of construction.	NAME OF WORKS.	SITUATION. P. O.	OWNERS.	Ore.	Bushels Coal consumed.	Largest Product. Tons.	Actual make 1849. Tons.	No. Men and boys employed.	No. oxen, Horses, mules employed.	BLAST. Tuyeres. No.	BLAST. Tuyeres. Diam.	STACK. Bosh. feet.	STACK. Height. feet.	Kind of Power used and No	Kind of metal made and No.	Capacity.
Armstrong,	1844 S		1	1840	Brady's Bend,	Brady's Bend,	M. P. Sawyer and others, of Boston,	C.						3	2½a3	11	40	Steam.	2, 3	2,000
"	1844 S		1	1841	"	"	"	"	1,120,000	10,000	0	900	100	3	"	11	40	"	"	2,000
"	1844 S		1	1843	"	"	"	"						3	"	13	50	"	"	3,500
"	1844 S		1	1846	"	"	"	"							"	14	50	"	"	4,500
	4		4																	12,000

nsylvania, in the year 1850.

STATE ne Land and Buildings in each County in EASTERN

COUNT	FORGES. S.* F.	FORGES. No.	FORGES. Investment.	ROLLING MILLS. S.* F.	ROLLING MILLS. No.	ROLLING MILLS. Investment	TOTAL. S.* F.	TOTAL. No.	TOTAL. Investment.	Counties.
1. Adams,		0			0			1	4,000	1.
2. Blair,	2	14	314,000		1	50,000	6	27	922,000	2.
3. Bedford,	2	3	18,000		0		4	6	53,000	3.
4. Berks,	5	23	320,000		5	310,000	8	41	1,231,000	4.
5. Bucks,		0			0			2	120,000	5.
6. Bradford.		0			0			0		6.
7. Carbon,		2	12,800		0		1	10	119,500	7.
8. Cumberl:	3	4	75,000		1	75,000	10	12	524,000	8.
9. Columbi:	1	1	5,000	1	3	303,000	10	20	1,107,500	9.
0. Chester,	1	6	106,000	2	14	642,200	3	25	1,248,200	10.
1. Centre,	2	5	63,000	2	5	114,000	10	20	665,000	11.
2. Clearfiel					0			1	84,000	12.
3. Clinton,		1	15,000		0		1	6	220,000	13.
4. Dauphin.		2	19,000	1	1	20,000	5	9	282,000	14.
5. Delaware		0			1	16,000		1	16,000	15.
6. Franklin	3	8	61,500	1	1	32,000	8	17	306,500	16.
7. Hunting	5	11	256,000	1	2	65,000	16	28	896,000	17.
8. Juniata,		0			0			0		18.
9. Lehigh,		0			0		1	9	478,000	19.
0. Lycomin		3	28,000		2	47,500	1	8	150,500	20.
1. Luzerne,		1	12,000	1	2	400,000	1	8	702,000	21.
2. Lebanon		3	70,000		0			9	685,000	22.
3. Lancaste	2	12	223,000		2	315,000	5	30	1,273,000	23.
4. Mifflin,	2	2	60,000		0		5	7	165,000	24.
5. Monroe,		0			0			1	15,000	25.
6. Montgon	1	2	20,000		4	187,000	2	12	503,000	26.
7. Northum		1	6,000		0		2	4	146,000	27.
8. Northam		0			1	35,000	2	6	297,000	28.
9. Potter,		0			0			0		29.
0. Perry,	1	1	60,000		1	185,000	4	7	365,000	30.
1. Pike,		0			0			0		31.
2. Philadel		3	45,000	2	8	307,000	2	11	352,000	32.
3. Susqueh:		0			0			0		33.
4. Sullivan		0			0			0		34.
5. Schuylki	4	6	127,000	1	1	20,000	6	12	254,500	35.
6. Tioga,		0			1	5,000	1	2	25,000	36.
7. Union,	1	1	6,000		0		3	4	37,000	37.
8. Wayne,		0			0			0		38.
. Wyomin		0			0			0		39.
. York,	1	3	90,000		0		3	8	368,000	40.
	36	118	2,012,300	12	56	3,128,700	120	364	13,614,700	

* Sold by t

† On 2 of t

ke the place

The remaining furnace will be completed and blown in, as it is to

STATEMENT, showing the number and condition of each sort of IRON WORKS, and the capital invested in the Land and Buildings in each County in EASTERN PENNSYLVANIA, in the year 1850.

COUNTY.	ANTHRACITE BLAST FURNACES.						CHARCOAL BLAST FURNACES. HOT BLAST.					COLD BLAST.					BLOOMERIES.			FORGES.			ROLLING MILLS.			TOTAL.			Counties.
	S.* F.	†Un-fin'sd.	In.	Out.	Total.	Investment.	S.* F.	In.	Out.	Total No.	Investment.	S.* F.	In.	Out.	Total No.	Investment.	S.* F.	No.	Invest-ment.	S.* F.	No.	Investment.	S.* F.	No.	Investment	S.* F.	No.	Investment.	
1. Adams,					0					0				1	1	4,000		0			0			0			1	4,000	1.
2. Blair,					0		4	4	4	8	283,000		4		4	275,000		0		2	14	314,000		1	50,000	6	27	922,000	2.
3. Bedford,					0		1		2	2	25,000	1		1	1	10,000		0		2	3	18,000		0		4	6	53,000	3.
4. Berks,			1		1	65,000	2	4		4	201,000	1	6	2	8	335,000		0		5	23	320,000		5	310,000	8	41	1,231,000	4.
5. Bucks,		1	1		2	120,000				0					0			0			0			0			2	120,000	5.
6. Bradford,					0					0					0			0			0			0			0		6.
7. Carbon,	1		1	1	2	15,000		1	1	2	80,000				0			4	11,700		2	12,800		0		1	10	119,500	7.
8. Cumberland,					0		2	1	1	2	215,000	5		5	5	159,000		0		3	4	75,000		1	75,000	10	12	524,000	8.
9. Columbia,	5		5	6	11	745,000	2	2	2	4	51,000	1	1		1	3,500		0		1	1	5,000	1	3	303,000	10	20	1,107,500	9.
10. Chester,			1	2	3	300,000				0			2		2	200,000		0		1	6	106,000	2	14	642,200	3	25	1,248,200	10.
11. Centre,					0		1	1	1	2	180,000	5	4	4	8	308,000		0		2	5	63,000	2	5	114,000	10	20	665,000	11.
12. Clearfield,					0				1	1	84,000				0			0						0			1	84,000	12.
13. Clinton,					0		1	1	2	3	195,000	2		2	2	10,000		0			1	15,000		0		1	6	220,000	13.
14. Dauphin,	1			2	2	103,000	1	1	1	2	100,000	2	2		2	40,000		0			2	19,000	1	1	20,000	5	9	282,000	14.
15. Delaware,					0					0								0			0			1	16,000		1	16,000	15.
16. Franklin,					0		1	2		2	101,000	3	1	5	6	112,000		0		3	8	61,500	1	1	32,000	8	17	306,500	16.
17. Huntingdon,					0		6	6	3	9	345,000	4	3	3	6	230,000		0		5	11	256,000	1	2	65,000	16	28	896,000	17.
18. Juniata,					0					0					0			0			0			0			0		18.
19. Lehigh,			6	1	7	410,000			1	1	60,000	1		1	1	8,000		0			0			0		1	9	478,000	19.
20. Lycoming,					0		1		1	1	25,000		1	1	2	50,000		0			3	28,000		2	47,500	1	8	150,500	20.
21. Luzerne,			2	2	4	270,000		1		1	20,000				0			0			1	12,000	1	2	400,000	1	8	702,000	21.
22. Lebanon,		1	1	1	3	195,000				0			2	1	3	420,000		0			3	70,000		0			9	685,000	22.
23. Lancaster,	3	1	5	3	9	305,000		3	2	5	335,000		1	1	2	95,000		0		2	12	223,000		2	315,000	5	30	1,273,000	23.
24. Mifflin,					0		3		4	4	95,000			1	1	10,000		0		2	2	60,000		0		5	7	165,000	24.
25. Monroe,					0					0					0			1	15,000		0			0			1	15,000	25.
26. Montgomery,	1		2	3	5	273,000				0				1	1	23,000		0		1	2	20,000		4	187,000	2	12	503,000	26.
27. Northumberland,	1		1	1	2	120,000				0		1		1	1	20,000		0			1	6,000		0		2	4	146,000	27.
28. Northampton,	1	1	2	1	4	260,000				0					0		1	1	2,000		0			1	35,000	2	6	297,000	28.
29. Potter,					0					0					0			0			0			0			0		29.
30. Perry,					0		2		3	3	90,000	1		2	2	30,000		0		1	1	60,000		1	185,000	4	7	365,000	30.
31. Pike,					0					0					0			0			0			0			0		31.
32. Philadelphia,					0					0					0			0			3	45,000	2	8	307,000	2	11	352,000	32.
33. Susquehanna,					0					0					0			0			0			0			0		33.
34. Sullivan,					0					0					0			0			0			0			0		34.
35. Schuylkill,	1	1	1		2	40,000		2		2	53,500			1	1	14,000		0		4	6	127,000	1	1	20,000	6	12	254,500	35.
36. Tioga,					0		1	1		1	20,000				0			0			0			1	5,000	1	2	25,000	36.
37. Union,					0		2	1	2	3	31,000				0			0		1	1	6,000		0		3	4	37,000	37.
38. Wayne,					0					0					0			0			0			0			0		38.
39. Wyoming,					0					0					0			0			0			0			0		39.
40. York,					0		2		5	5	278,000				0			0		1	3	90,000		0		3	8	368,000	40.
	14	5	29	23	57	3,221,000	32	31	36	67	2,867,500	27	27	33	60	2,356,500	1	6	28,700	36	118	2,012,300	12	56	3,128,700	120	364	13,614,700	

* Sold by the Sheriff, or failed, since 1840.

† On 2 of these furnaces the work has been suspended over a year. On 2 others the work will be completed, but they will not be blown in. The remaining furnace will be completed and blown in, as it is to take the place of another one worn out.

nsylvania, in the year 1850.

COU	No. men and boys employed.	No. oxen, horses and mules employed.	BLAST. Heat.	BLAST. Tuyeres. No.	BLAST. Tuyeres. Diam.	BLAST. Pres'e.	STACK. Bosh. feet.	STACK. Height. feet.	Kind of Power used, and No.	Kind of Metal made, and No.	Annual Capacity. Tons.
	50	35	500°	3	3	3a4	14	37	Steam.	1	3,500
rks,	103	32	500	3	3	3	13	40	"	2, 3	8,000
icks,	70	5	612	3	$2\frac{3}{4}$	4	9	31	"	3	3,150
olumbi	70	5	"	3	"	$4\frac{1}{2}$	12	33	"	3	4,100
do.	70	5	"	3	"	"	"	"	"	3	4,100
do.	70	5	"	4	"	$4\frac{5}{8}$	14	34	"	3	6,500
do.	45	25	"	3	4	2	8	30	"	2, 3	2,000
do.	45	45	"	3	3	3	$8\frac{1}{2}$	32	Water.	1, 2	2,000
do.	50	20	"	3	$2\frac{1}{2}$	5	$8\frac{1}{2}$	30	Steam.	1, 2	2,500
do.	180	80	550	3	$3\frac{3}{4}$	$2\frac{1}{2}$	14	35	Water.	2, 3	10,200
do.	40	25	500	3	3	$1\frac{1}{2}$	8	30	"	2, 3	2,000
do.	40	20	"	3	$2\frac{1}{2}$	$1\frac{3}{4}$	9	32	"	2, 3	2,000
do.	53	8	"	3	3	3	$8\frac{1}{2}$	34	"	1, 2	2,000
arbon,							8	28	"		2,000
do.			612	3	3	4	12	38	Steam.	2, 3	4,100
hester	371	114	612	3	3	4	12	"	"	2, 3	4,100
do.			"	3	3	4	14	"	"	2, 3	5,000
do.	71	48	"	3	$3\frac{1}{4}$	$3\frac{3}{4}$	12	35	"	1, 2	3,800
auphi	30	7	"	3	$2\frac{5}{8}$	$2\frac{1}{2}$	8	"	S &W.	"	2,000
do.		300	"	3	3	4	11	45	Water.	"	4,000
ehigh,	500		"	4	"	"	13	"	"	"	5,000
do.			"	6	"	"	17	"	Steam.	"	7,200
do.			"	7	"	"	18	40	"	"	8,000
do.			"	7	"	"	18	"	"	"	8,000
do.	200	250	"	3	$2\frac{3}{4}$	$2\frac{1}{2}$a3	12	35	"	"	5,000
do.			"	3	"	$2\frac{1}{2}$a3	12	35	"	"	5,000
do.		225	450	3	$2\frac{1}{2}$	2	11	33	Water.	3	2,000
uzern	500		"	3	$3\frac{1}{2}$	$2\frac{1}{2}$	14	35	Steam.	3	3,500
do.			"	3	$3\frac{1}{2}$	"	14	35	"	3	3,500
do.	50	20	"	3	$2\frac{1}{2}$	1	9	33	"	3	1,500
do.		100	"	3	4	4	14	35	"	1, 2, 3	6,000
ebanc	213		"	3	5	4	12	35	"	"	5,000
do.			"	3	4		12	38	"	"	5,000
do.	100	34	"	6	$3\frac{1}{4}$	$3\frac{3}{4}$	14	45	"	3	5,000
ancas	28	60	"	2	4		8	28	"	1, 2	2,000
do.	28	71	612	3	3		$8\frac{1}{2}$	31	"	"	2,000
do.	24	30	"	3	3	$3\frac{1}{4}$	8	30	"	"	2,000
do.	50	36	"	3	$3\frac{1}{2}$	$2\frac{3}{4}$	9	35	"	"	2,800
do	45	40	"	3	3	$2\frac{1}{2}$	8	32	"	1, 2, 3	2,500
do	46	44	"	3	3	4	10	35	"	"	3,800
do	58	45	"	3	$3\frac{1}{2}$	$3\frac{1}{2}$	10	33	"	"	3,800
do			"	3	"	"	10	33	"	"	3,800
do	185	40	"	3	3	3	11	36	"	1, 2	3,350
Montg	120	40	"	3	3	$3\frac{1}{2}$	14	38	"	"	3,500
	100	40	"	3	3	4	12	40	"	3, 4	4,000
	110	20	"	6	$2\frac{1}{2}$	4	14	42	"	1, 2	4,000
	95	42	"	6	$2\frac{1}{4}$	$2\frac{1}{2}$	13	33	"	"	3,500
	65	50	"	3	4	$3\frac{1}{2}$	14	34	"	2, 3	4,500
North	40	25	"	3	3	$4\frac{1}{4}$	12	45	"	1, 2	3,500
	50	20	"	3	$2\frac{3}{4}$	$3\frac{1}{2}$	11	37	Water.	"	3,500
North	200	90	500	3	3	3	10	45	"	1, 2, 3	4,000
			"	4	"	"	12	45	"	"	6,300
			"	5	"	"	12	35	Steam.	"	6,300
	60	25	612	3	3	4	9	34	"	1	2,000
Schu			"	3			14	32	"	1, 2	3,500
	4,225	2,126									221,400

———, Bog Ore.

A Detailed Statement of all the ANTHRACITE BLAST FURNACES in the State of Pennsylvania, in the year 1850.

COUNTY.	Sold by Sheriff, or failed, and date.	No. FURNACES. Un-fin'sd.	In Blast.	Out of Blast.	Date of construction.	NAME OF WORKS.		SITUATION. P. O.	OWNERS.	LESSEES.	* Kind of Ore used.	Largest Product. Tons.	Actual make 1849. Tons.	No. men and boys employed	No. oxen, horses and mules employed.	BLAST. Heat.	Tuyeres. No.	Tuyeres. Diam.	Pres're.	STACK. Bosh. feet.	Height. feet.	Kind of Power used, and No.	Kind of Metal made, and No.	Annual Capacity. Tons.
Berks,			1		1846	Henry Clay,		Reading,	Eckert & Bro.,	None.	H. M.	3,484	3,256	50	35	500°	3	3	3a4	14	37	Steam.	1	3,500
Bucks,		1	1		1848	Durham,		Durham,	Jos. Whitaker & Co.	"	"	3,840	3,840	103	32	500	3	3	3	13	40	"	2, 3	8,000
Columbia,	1843 S			1	1838†	Montour,	1	Danville,	Montour I. Co.	"	F.	3,135		70	5	612	3	2¾	4	9	31	"	3	3,150
do.	1844 S			1	1839	"	2	"	"	"	"	4,042		70	5	"	3	"	4½	12	33	"	3	4,100
do.	1844 S		1		1839	"	3	"	"	"	"	3,523	1,953	70	5	"	3	"	"	"	"	"	3	4,100
do.			1		1846	"	4	"	"	"	"	6,449	6,449	70	5	"	4	"	4⅝	14	34	"	3	6,500
do.	1842 S			1	1846	Franklin,		"	Jacob B. Maus & Co.	"	"	1,000	200	45	25	"	3	4	2	8	30	"	2, 3	2,000
do.	1848 F			1	1840	Roaring Creek,		"	Trustees U. S. Bank,	"	"	2,000		45	45	"	3	3	3	8½	32	Water	1, 2	2,000
do.			1		1840	Columbia,		"	Geo. Patterson,	J. P. & J. Grove,	"	2,500	1,600	50	20	"	3	2½	5	8½	30	Steam.	1, 2	2,500
do.			2		1845	Iron Dale,		Bloomsburg,	Bloomsburg I. Co.	None.	"	10,200	8,132	180	80	550	3	3¾	2½	11	35	Water	2, 3	10,200
do.				1	1845	Williamsburg,		Light Street,	M. McDowell,	"	"	1,200	800	40	25	500	3	3	1½	8	30	"	2, 3	2,000
do.				1	1847	Light Street,		"	Light Street I. Co.	"	"	1,000	550	40	20	"	3	2½	1¼	9	32	"	2, 3	2,000
Carbon,	1848 F		1		1838	Carbon,		Mauch Chunk,	J. Richards & Sons,	"	H. M.	1,500	1,500	53	8	"	3	3	3	8½	34	"	1, 2	2,000
do.				1	1826	Mauch Chunk,		"	Lehigh C. & N. Co.	"	"	4,052								8	28	"		2,000
Chester,				1	1845	Phœnix,	1	Phœnixville,	Reeves, Buck & Co.	"	"		1,534			612	3	3	4	12	38	Steam.	2, 3	4,100
do.			1		1845	"	2	"	"	"	"	3,910	3,910	371	114	612	3	3	4	12	"	"	2, 3	4,100
do.				1	1847	"	3	"	"	"	"	4,718	2,581			"	3	3	4	14	"	"	2, 3	5,000
Dauphin,				1	1845	Harrisburg,		Harrisburg,	D. R. Porter,	"	H.	3,614	3,360	71	48	"	3	3¼	3¾	12	35	"	1, 2	3,800
do.	1847 S			1	1834‡	Emeline,		Dauphin,	A. C. Bayard,	"	"	600		30	7	"	3	2⅝	2½	8	"	S & W.	"	2,000
Lehigh,				1	1840	Crane,	1	Catasauqua,	Lehigh Crane I. Co.	"	H. M.	3,958	3,639		300	"	3	3	4	11	45	Water	"	4,000
do.			1		1842	"	2	"	"	"	"	4,833	4,494	500		"	4	"	"	13	"	"	"	5,000
do.			1		1846	"	3	"	"	"	"	7,144	6,139			"	6	"	"	17	"	Steam.	"	7,200
do.			1		1850	"	4	"	"	"	"					"	7	"	"	18	40	"	"	8,000
do.			1		1850	"	5	"	"	"	"					"	7	"	"	18	"	"	"	8,000
do.			1		1846	Allentown,	1	Allentown,	D. E. Wilson & Co.	"	"	5,000	4,200	200	250	"	3	2¾	2½a3	12	35	"	"	5,000
do.			1		1847	"	2	"	"	"	"	5,000	4,200			"	3	"	2½a3	12	35	"	"	5,000
Luzerne,				1	1842	Lackawanna,	1	Scrantonia,	Scrantons & Platt,	"	F. C.	1,800	1,800		225	450	3	2½	2	11	33	Water	3	2,000
do.			1		1849	"	2	"	"	"	"	300	300	500		"	3	3½	2½	14	35	Steam.	3	3,500
do.			1		1849	"	3	"	"	"	"	300	300			"	3	3½	"	14	35	"	3	3,500
do.				1	1847	Jim Crack,		Wilkesbarre,	H. B. Renwick,	"	F.	1,300		50	20	"	3	2½	1	9	33	"	3	1,500
Lebanon,				1	1847	Lebanon,	1	Lebanon,	R. & G. D. Coleman,	"	M.	3,778	3,659	213	100	"	3	4	4	14	35	"	1, 2, 3	6,000
do.			1		1848	"	2	"	"	"	"	3,354	3,188			"	3	5	4	12	35	"	"	5,000
do.		1			1850	Cornwall,		Cornwall,	R. W. & W. Coleman,	"	"					"	3	4		12	38	"	"	5,000
Lancaster,			1		1848	Safe Harbor,		Safe Harbor,	Reeves, Abbott & Co.	"	H.	2,879	2,879	100	34	"	6	3¼	3¾	11	45	"	3	5,000
do.	1849 S			1	1844	Shawnee,		Columbia,	Wright & Nephew,	"	"	1,000		28	60	"	2	4		8	28	"	1, 2	2,000
do.	1849 S		1		1848	Cordelia,		"	Bryan & Longnecker,	"	"	700	250	28	71	612	3	3		8½	31	"	"	2,000
do.	1842 S			1	1841§	Sarah Ann,		"	Jno. B. Hertzler,	D. R. Porter,	"	1,664	200	21	30	"	3	3	3¼	8	30	"	"	2,000
do.			1		1845	Henry Clay,		"	Jno. Haldeman,	None.	"	2,678	2,159	50	36	"	3	3½	2¾	9	35	"	"	2,500
do.			1		1846	Chickiswalungo,		"	E. Haldeman & Co.	"	"	2,464	1,500	45	40	"	3	3	2½	8	32	"	1, 2, 3	2,500
do.				1	1847	Donegal,		"	Eckert & Stein,	"	"	3,472	3,472	46	44	"	3	3	4	10	35	"	"	3,800
do.			1		1849	Marietta,		"	Shoenberger & Musselman,	"	"	3,763	3,763	58	45	"	3	3½	3½	10	33	"	"	3,800
do.		1			1850	"		"	"	"	"					"	3	"	"	10	33	"	"	3,800
Montgomery,			1		1845	Plymouth,		Conshohocken,	S. Colwell,	"	"	3,338	2,492	185	40	"	3	3	3	11	36	"	1, 2	3,350
do.			1		1848	Merion,		"	Colwell & Co.	"	"	3,174	3,174	120	40	"	3	3	3½	14	38	"	"	3,500
do.				1	1844	Spring Mill,		"	Est. Farr & Kunzi,	D. Reeves,	"	1,000		100	40	"	3	3	4	12	40	"	3, 4	4,000
do.				1	1850	Swede,		Philadelphia,	Potts & Jones,	None.	"			110	20	"	6	2½	4	14	42	"	1, 2	4,000
do.	1849 S			1	1845	Wm. Penn,		Conshohocken,	Hitner, Reeves & Co.	"	"	3,120	2,044	95	42	"	6	2¼	2½	13	33	"	"	3,500
Northumberland,			1		1846	Chulasky,		Chulasky,	S. R. Wood,	"	F.	4,000	3,500	65	50	"	3	4	3½	14	34	"	2, 3	4,500
do.	1846 S			1	1842	Shamokin,		Shamokin,	Claghorn, Richards & Co.	"	C. B. F.	1,380		40	25	"	3	3	4¼	12	45	"	1, 2	3,500
Northampton,	1849 S		1		1842	S. Easton,		Easton,	Thomas & Mills,	"	H. M.	3,140	3,140	50	20	"	3	2¾	3½	11	37	Water	"	3,500
do.				1	1844	Glendon,	1	"	Chas. Jackson, Jr.	"	"	3,978	3,978	200	90	500	3	3	3	10	45	"	1, 2, 3	4,000
do.			1		1845	"	2	"	"	"	"	6,253	4,469			"	4	"	"	12	45	"	"	6,300
do.		1			1850	"	3	"	"	"	"					"	5	"	"	12	35	Steam.	"	6,300
Schuylkill,	1849 S		1		1838	Pioneer,		Pottsville,	The Greenwood Co.	Patterson, Richards & Co.	H. C.	1,742	570	60	25	612	3	3	4	9	34	"	1	2,000
do.		1				St. Clair,		St. Clair,	Burd Patterson,	None.	C.					"	3			11	32	"	1, 2	3,500
	14	5	29	23								151,331	109,168	4,225	2,126									221,400

* In the column of Ores, H. signifies Brown Hematite; M., Magnetic; F., Fossiliferous Red Oxyde; C., Carbonate; B., Bog Ore.
† Altered from Charcoal 1839. ‡ Altered from Charcoal 1848. § Altered from Charcoal 1845.

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A Detailed Statement of all the HOT BLAST CHARCOAL FURNACES IN EASTERN PENNSYLVANIA, in the year 1850.

COUNTY.	Sold by Sheriff, or failed.	No. Furnaces. In Blast.	No. Furnaces. Out Blast.	Date of construction.	NAME OF WORKS.	SITUATION. POST OFFICE.	OWNERS.	LESSEES.	Kind of Ores used.	Largest Product. Tons.	Actual make in 1849. Tons	No. of men and boys employed.	No. oxen, horses and mules employed.	BLAST. Heat.	BLAST. Tuyeres No.	BLAST. Tuyeres Diam	BLAST. Pressure	STACK. Bosh. feet.	STACK. Height. feet.	Kind of Power used.	Kind of Metal made. No.	Market for sales	Capacity Tons
Blair,	1849 S		1	1836	Elizabeth,	Frankstown,	Samuel Good & Co.		F.	1,000		100	25	Hot.	2			8½	32	W &S.	3	W.	1,600
do.		1		1815	Springfield,	Springfield Furnace,	Royer & Co.		F. & H.	1,820	1,560	80	50	"	2			8	30	Water.	3	"	1,820
do.	1850 S		1	1816	Gap,	E. Freedom,	Ed. F. Shoenberger,		F. & H.	1,260	1,260	45	43	"	1	2½		8½	32	"	3	"	1,600
do.		1		1811	Alleghany,	Hollidaysburg,	Elias Baker,		H.	1,751	1,062	80	60	"	2	2½		9	32	"	1, 2, 3	"	1,800
do.		1		1846	Blair,	Collinsville,	H. McNeall,		F. & ½ H.	911	911	76	27	"	2	2½		8	36	Steam.	3	W. & H.	1,100
do.			1	1832	Elizabeth,	Antestown,	Martin Bell,		H.	883	551	50	20	"	2	2½		8½	34	Water	3	W.	1,600
do.	1850 F	1		1805	Ætna,	Yellow Spring,	Spang, Keller & Co.		F. H.	1,000	1,000	100	38	"	1	2½		8	31	"	3	"	1,100
do.	1850 F		1	1837	Canoe,	Williamsburg,	"		H.	1,180				"	2	2½		8	31	Steam.	3	"	1,400
Bedford,	S		1	1800	Hopewell,	Hopewell,	McDowell, Benedict and others,		F.	500	300	50	20	"	1			7	32	Water	3	E. & W.	1,000
do.			1	1816	Hanover,	McConnelsburg,	John Potts,		H.	300		50	25	"	2	2½		7	30	"		H.	1,000
Berks,	1842 F	1		1777	Reading,	Furnace,	H. P. Robeson & Co.		M.	2,200	1,800	100	80	"	2	2	1½	9	30	"	2, 3		2,200
do.		1		1816	Hampton,	Hampton,	E. & George Brooke,		M.	1,550	1,550	50	30	"	2	2¾	1	7½	30	"	2, 3		1,200
do.		1		1836	Alsace,	Reading,	Clymer, Kaufman & Co.		H.	850	450	40	40	"	1	2		7½	30	"	1, 2, 3		1,550
do.	1842 S	1		1820	Windsor,	Mohrsville,	Darrach & Jones,		H.	1,200	900	50	50	"	2	3		7½	30	"			1,2 0
Carbon,		1		1831	Maria,	Lehighton, 2 m.	Thos. M. Smith & Est. T. S. Richards,		H.	2,059	1,881	153	58	600°	1		3	8	30	"	1		2,060
do.			1	1837	Pennsville,	E. Penn,	S. Balliet & Co.		H.	780	624	61	55	500°	1	2½		7	30	"	1		1,000
Cumberland,	1837 S	1		1770	Pine Grove,	Carlisle,	Wm. M. Watts,		H.	1,600	500	61	41	Warm	2	2½		8	33	"	1		1,600
do.	1849 S		1	1795	Holley,	Papertown,	Farmers and Mechanics Bank,		M. & H.	800	350	70	40	"	2	2½		8	33	"	2, 3		1,400
Columbia,	1848 S		1	1839	Liberty,	Mooresburg,	Trustees U. S. Bank,		F.	1,000		80	30	Hot.	2	2½		8	30	Steam.	1, 2		1,400
do.		1		1836	Esther,	Catawissa, 3½,	S. B. Deemer,		F.	1,600	900	60	50	"	2	2½		7½	30	Water.	2, 3		1,600
do.		1		1845	Peno,	Catawissa, ¾,	Fincher & Thomas,		F.	854	854	70	60	"	2	3		7½	29	"	2, 3		1,200
do.	1849 S		1	1837	Briar Creek,	Berwick, 2,	Charles Kalbfus,		F.	680	275	30	15	"	2	2¼ & 2¾		7	27	"	2, 3		1,000
Centre,		1		1790	Centre,	Bolesberry,	Thompson, McCoy & Co.		H.	1,400	1,200	75	50	"	2	3		8	30	"	3		1,400
do.	1849 S		1	1826	Hecla,	Zion,	Boyd & Cummings,		H.	1,000		60	18	"	1	2½		8	30	"	3		1,400
Clearfield,			1	1815	Karthaus,*	K.,	P. A. Karthaus, Jr.		C.	1,820		120	20	400°	3	2½	2	12	45	"	3		2,000
Clinton,	1849 S	1		1830	Mill Hall,	Mill Hall,	Wharton, Morris & Co.		H.	1,360	1,360	70	45	H t.	2	4		8½	28	"	2, 3		1,600
do.			1	1811	Washington,	Kittany,	John Henderson,	W. Morris & Co.	H.	1,100		70	45	"	1			8	30	"	2, 3		1,400
do.			1	1834	Farrandsville,*	Farrandsville,	John O. Stearns,		F.	1,100		70	25	"	2			10	45	"	2, 3		2,000
Dauphin,	1847 S		1	1830	Victoria,	Dauphin,	A. C. Bayard,		H.	2,200		90	80	"	2	2½ & 3		9	45	"	1, 2		2,200
do.		1		1837	Manada,	W. Hanover,	E. & C. B. Grubb,	Grubb & Kintzer.	M.	2,215	1,800	100	70	600°	2	2¼	1¾	8¼	32	"	3		2,215
Franklin,	1842 F	1		1805	Montalto,	Montalto,	H. & H. Hughes,		H.	1,000	1,000	150	30	Hot.	2	2½ a 3		9	33	"	2, 3		1,500
do.		1		1837	Caledonia,	Grafenburg, Adams Co.	Thaddeus Stevens,		H.	800	750	80	34	"	2	2 a 3		8	33	"			1,400
Huntingdon,	1849 S	1		1844	Monroe,	Pine Grove, Centre Co.	James Irvin,		H. & F.	900	900	60	30	"	2	2		9	33	"	1, 2, 3		1,800
do.	S	1		1838	Mill Creek,	Mill Creek,	Irvin, Green & Co.		⅔ H. & ⅓ F.	1,367	1,367	70	40	"	1	2¾		8	30	"	3	E. & W.	1,400
do.	S	1		1816	Union,	Spruce Cr.,	Wallace's Heirs,	G. W. Patton & Co.	H.	1,200	800	60	25	"	1	2¼		8	30	"	2, 3	E. & W.	1,400
do.			1	1796	Huntingdon,	Warrior's Mark,	George K. Shoenberger,		H.	1,650	1,100	130	50	"	1	2½		8½	33	"	3	W.	1,650
do.		1		1839	Edward,	Vineyard Mills,	Samuel H. Bell,		F. & H.	960	575	50	36	"	2	2		8½	32	"	2, 3	W.	1,600
do.	S		1	1832	Winchester,	Orbisonia,	T. T. Cromwell,	J. Wigton & Co.	H.	500	500	40	30	"	1	2½		8	28	"	2, 3	W.	1,400
do.	S	1		1830	Rockhill,	"	Isett, Wighton & Co.		F. & H.	850	850	40	34	"	2	2½		8	30	"	3	E.	1,400
do.	S		1	1837	Chester,	"	Pennock's Heirs,		H.	500		80	24	"	2			9	45	S &W.	2, 3	E.	1,800
do.		1		1849	Rough and Ready,	Coffee Run,	James Entricken,	Wigton & Moore.	F. & ½ H.	357	357	48	27	"	2	2½		9	32	Water.	3	E.	1,500
Lehigh,			1	1826	Lehigh,	N. Whitehall,	S. Balliet & Co.		H.	1,430	1,201	90	60	500°	1	2¾		7½	31	"	1		1,200
Lycoming,	1843 S		1	1837	Ralston,	Ralston,	Lycoming Valley Iron Co.		C.	1,000		41	37	600°	3	3¼		10	35	"	2		2,000
Luzerne,		1		1846	Shickshinny,	Shickshinny,	Wilson & Koons,		F.	1,600	1,600	62	24	Hot.	2	2		9	30	"	1, 2		1,500
Lancaster,		1		1756	Elizabeth,	Brickerville,	R. & G. D. Coleman,		M.	1,900	1,500	60	50	460°	2	1½	1	9	29	S &W.	1, 2, 3		1,900
do.		1	1	1832	Rock,†	Peningtonville,	Charles Brooks, Jr., & Co.		H.	1,156	1,051	100	90	"	2	2	1½	8½	29	"	1, 2, 3		1,200
do.			1	1800	Mount Vernon,	Elizabethtown,	E. & C. B. Grubb,		M.	1,300		100	30		2	2½		8	32	"	2, 3		1,400
do.		1		1809	Conowingo,	Buck,	James M. Hopkins,		H.	1,300	870	110	75	212°	1	3		7½	30	"	1, 2		1,200
Mifflin,			1	1816	Isabella,	Lewistown,	A. B. Long,		F. & H.	1,300		55	40	Hot.	2	2¾		9	30	"	1, 2	E.	1,800
do.	S		1	1810	Hope,	Lewistown, 6 m.	D. W. Hewling,		F. & H.	1,000	1,000	55	30	"	2	2½		8½	31	"			1,600
do.	1849 S		1	1838	Brookland,	Waynesburg,	H. N. Burroughs,		H.	1,200		100	40	"	2	3		8	32	"	2, 3	E.	1,400
do.	1847 F		1	1838	Matilda,	Jackstown P. O. Huntingd'n Co.	J. F. Cottrell,		F.	1,200	800	60	30	"	2	2½		8	33	Steam.	1, 2	E.	1,400
Perry,	1847 S		1	1840	Perry,‡	Bloomfield,	Loy, Everhart & Co.		F. & H.	500		40	35	"	1			7		Water.	1, 2		1,000
do.	1849 S		1	1808	Juniata,	Newport, 3 m.	Cathcart & Co.		F. & H.	800	400	50	30	"	2			8		"	1, 2		1,400
do.			1	1836	Montebello,	Duncannon,	Fisher, Morgan & Co.		F.	1,449	1,185	70	35	"	2	1½		8½	32	"	2, 3		1,600
Schuylkill,		1		1830	Swatara,§	Pine Grove, 6 m.	Eckert & Guilford,		M.	1,880	1,300	103	33	Cold.	2	2½		9	32	"	1, 2		1,880
do.		1		1835	Stanhope,	Pine Grove, 2 m.	W. S. & J. R. Breitenbach,		H.	788	788	65	38	Hot.	1	2½		7½	30	"	1, 2		1,200
Tioga,	1849 F	1		1841	Blossburg,	Blossburg,	James H. Gulick,		F. C. B.	700	700	40	16	400°	1	4		7½	31	"	1, 2		1,200
Union,	S		1	1827	Berlin,	Hartleytown, 4 m.	C. & C. Brooke,		F.	900		60	30	H t.	2			8	31	"	2, 3		1,400
do.	1848 S		1	1816	Forest,	Milton, 6 m.	Kaufman, Reher & Co.		F.	700		36	20	"	2			9	30	"	1, 2		1,800
do.		1		1818	Beaver,	Middleburg,	Middleswarth, Kerns & Co.		F.	1,200	1,200	50	36	"	2	2¾		8½	30	"	1, 2		1,600
York,	1842 S		1	1823	Margaretta,	Margaretta,	Hahn & Himes,	Curran, Himes & Co.	H.	1,100	715	100	30	"	2	2 & 3		7	32	Steam.	1, 2		1,200
do.			1	1827	Manor,	Chanceford,	John Herr,		H.	1,000	100	80	40	"	1	2		8	32	Water.	1, 2		1,100
do.			1	1830	York,	Chanceford,	John Bair,		H.	1,000	700	80	30	"	2	2½		9	32	"	1, 2		1,800
do.			1	1836	Codorus,	Manchester,	E. & C. B. Grubb,		H.	2,400	1,900	100	30	"	2	3		8	32	"	1, 2		1,100
do.	1842 S		1	1842	Woodstock,	Margaretta,	Hahn & Himes.	Curran, Himes & Co.	H.	1,000		75	20	"	2			10	40	"			2,000
	32	31	36							77,860	46,336	4,694	2,499										101,475

* Built for a Coke Furnace. † Now running Cold Blast. ‡ Abandoned. § Blast now running Cold, have a Hot.

STERN

COUN	Kind of usec
	M.
Adams,	H.
Blair,	H.
do.	H.
do.	H.
do.	$\frac{1}{4}$ F. &
Bedford	M.
Berks,	H.
do.	M.
do.	M.
do.	M. &
do.	H.
do.	M. & I
do.	M. & I
do.	H.
Cumberl	H.
do.	H.
do.	$\frac{1}{3}$ M. &
do.	F. & H
do.	F.
Columbi	H.
Centre,	H.
do.	H.
do.	H.
do. Co.	H.
do.	H.
do.	$\frac{1}{8}$ F. & H
do.	H.
Clinton,	H.
do.	M.
Chester,	M.
do.	M.
Dauphin	M.
do.	H.
Franklin	H.
do.	H.
do.	H.
do.	H.
do.	H.
do.	F.
Hunting	H.
do.	H.
do.	H.
do.	$\frac{3}{4}$ F. & $\frac{1}{4}$ H

A Detailed Statement of all the COLD BLAST CHARCOAL FURNACES IN EASTERN PENNSYLVANIA, in the year 1850.

COUNTY.	Sold by Sheriff, or failed.	No Furnaces. In Blast	Out Blast.	Date of construction.	NAME OF WORKS.	SITUATION. POST OFFICE.	OWNERS.	LESSEES.	Kind of Ores used.	Largest Product Tons.	Actual make in 1849. Tons.	No. of men and boys employed	No. oxen, horses and mules employed.	BLAST. Cold.	Tuyeres No.	Diam.	Pressure.	STACK. Bosh feet.	Height. feet.	Kind of Power used.	Kind of Metal made	Market for sales.	Capacity Tons
Adams, . .			1	1830	Chesnut Grove,	Whitestown,	J. V. Boggs,	None.	M.	500		56	35	cold	1			8	32	Water			1,100
Blair, . .		1		1824	Bald Eagle,	Warrior's Mark, Huntingd'n Co.	Lyon, Shorb & Co.		H.	1,830	1,700	118	40	"	1	2½		8½	34	"	3	W.	1,830
do.		1		1819	Rebecca,	Martinsburg,	D. P. Schoenberger,		H.	1,500	1,300	60	50	"	1	"		8½	32	"	3	W.	1,500
do.		1		1846	Bloomfield,	Sarah,	"		H.	1,350	1,000	75	32	"	1	"		8½	30	Steam.	3	W.	1,350
do.		1		1833	Sarah,	"	"		H.	1,400	1,200	70	55	"	1	"		8½	32	Water	3	W.	1,400
Bedford, . .	1848 S		1	1841	Lemnos,	Hopewell,	Thos. King & Co.		½ F. & H.	400	291	74	30	"	1	2½		8½	30	Steam.	3	H. & W.	1,350
Berks, . .		1		1759	Hopewell,	Douglasville,	Clement, Brooke & Co.		M.	1,150	1,000	80	50	"	1		¾	6½	30	Water	1	E.	1,150
do.		1		1816	Mossilm,	Mossilm,	N. V. R. Hunter,	F. S. Hunter.	H.	1,200	1,200	60	54	"	1	2		8.9	32	"	2, 3	"	1,350
do.		1		1793	Joanna,	Joanna,	Darling & Smith,		M.	1,050	1,050	50	30	"	1			7.6	31	"	2, 3	"	1,050
do.		1		1827	Mount Penn,	Reading, 4 m.	John Schwartz,		M.	1,050	897	100	64	"	1	2⅛		8	31	"	2, 3	"	1,100
do.		1		1797	Mary Ann,	Long Swamp,	Hort. Trexler,		M. & H.	1,000	800	59	35	"	1	2⅛		7	30	"	1, 3	"	1,000
do.		1		1791	Sally Ann,	New Jerusalem,	J. V. R. Hunter,		H.	850	750	60	40	"	1	2⅛		6	32	"	1, 2, 3	"	850
do.			1	1835	Oley,	Oley,	Jacob S. Spang,		M. & H.	800		60	35	"	1		¾	6½	28	"	1	"	800
do.	1842 S		1	before 1770	Old Oley,	Pricetown,	George Merkel,		M. & H.	800				"	1			9	28	"	1	"	1,400
Cumberland, .	1846 S		1	1826	Mary Ann,	Shippensburg,	Carlisle Bank,		H.	800		80	25	"	1	2½		8	32	"	3	"	1,100
do.	1846 S		1	1828	Augusta,	"	J. M. Haldeman,		H.	800		80	25	"	1	2½		8	32	S &W.	3	"	1,100
do.	1847 S		1	1815	Carlisle,	Carlisle,	Peter F. Ege,		H.	875		56	29	"	1	1¾		7½	25	Water.	2	"	1,000
do.	1849 F		1	1794	Cumberland,	Dickinson,	Thomas C. Miller,		½ M. & H.	400	247	40	25	"	1	2		8½	30	"	2, 3	"	1,350
do.	1847 S		1	1836	Big Pond,	Shippensburg,	Schoch, Sons & Co.		F. & H.	871	871	75	50	"	1	2½		7½	30	"	3	"	1,000
Columbia, . .	1847 S	1		1815	Catawissa,	Maineville,	B. P. Frick,		F.	750	500	53	50	"	1	3½		8½	32	"	1, 2	"	1,350
Centre, . .	1843 S		1	1832	Martha,	Martha Furnace P. O.	Rowland Curtin & Sons,		H.	1,180		70	60	"	1	2½		8	32	"	3	"	1,180
do.	1843 S	1		1818	Eagle,	Milesburg,	C. & J. Curtin,		H.	800	800	80	45	"	2	2¼		8	30	"	3	"	1,100
do.		1		1800	Logan,	Bellefonte,	Valentines & Thomas,		H.	1,320	1,320	40	36	"	1	3	⅜	8	31	"	3	"	1,320
do.	1850 F	1		1816	Rock,	Bellefonte, 5 m.	Samuel Edmiston,		H.	700	700	35	36	"	1	1¾		7	28	"	3	"	900
do.	1844 S		1	1828	Hannah,	Centre Line,	Lyon, Shorb & Co.	Campbell, Stevens & Co.	H.	1,261	800	100	40	"	1	2½		8½	33	"	3	W.	1,350
do.	1849 S		1	1835	Juliana,	Juliana,	John Adams,		H.	1,000	250	60	30	"	1	2½		8½	33	"	3	E.	1,350
do.		1	1	1830	Howard,	Howard,	Irvin, Thomas & Co.		⅛ F. & H.	1,400	1,400	50	30	"	1	"		8½	33	"	3	"	1,400
Clinton, . .	1839 S		1	1834	Sugar Valley,	Loganville,	J. T. Hale,		H.	400				"	1						1	"	800
do.	1839 S		1	1831	Lamar,	Salona,	Solomon McCormick,		H.	750				"	1			8		"	2, 3	"	1,100
Chester, . .		1		1835	Isabella,	Rockville,	David Potts & Co.		M.	1,000	1,000	75	45	"	1	2¼		6½	33	"	2, 3	"	1,000
do.		1		1736	Warwick,	Pottstown,	David Potts, Jr.		M.	1,400	1,100	100	50	"	1	2¼		7	33	"	2, 3	"	1,400
Dauphin, . .	1847 S	1		1849	Middletown,	Middletown,	Peters & Gamber,	Grubb & Cabean.	M.		470	70	42	"	1	2		6½	30	"	1	"	800
do.	1847 S	1		1833	"	"	"	"	M.					"	1	2		8½	"	"	1	"	1,350
Franklin, . .	1849 S	1		1800	Carrick,	Faussetsburg, 4 m.	N. Kelley,	Witherow & Walker.	H.	400		10	5	"	1	2½		7½	30	"	2, 3	H.	1,000
do.	1849 S		1	1830	Southampton,	Shippensburg, 3½,	Alfred Bujac,		H.	900		60	33	"	1	2		9½	30	"	1, 2, 3	E.	1,500
do.	1849 S		1	1835	Mary,	" 4,	"		H.	1,100	360	60	33	"	1	2		9	30	"	1, 2, 3	"	1,400
do.			1	1828	Franklin,	St. Thomas, 4,	B. Phreaner & Sons,		H.	800	110			"	1	1½		9	30	"	2, 3	H.	1,400
do.			1	1825	Valley,	Louden, 2,	John Beaver,	Scheffler & Son.	H.	300	50	15	6	"	1	1½		6	28	"	2, 3	H.	800
do.			1	1835	Warren,	Sylvan,	Bowers' heirs,		H.	227		35	6	"	1	1¼		8	28	"	2	E.	1,100
Huntingdon, .	1849 S		1	1846	Rebecca,	McElavey Fort P. O.	A. G. Curtin,		F.	700	700	40	23	"	1	1¾		6½	27	"	3	"	800
do.		1		1813	Pennsylvania,	Baileysville,	Lyon, Shorb & Co.		H.	2,309	1,792	120	50	"	1	2½		8½	35	"	3	W.	2,310
do.	1847 S	1		1833	Greenwood,	14 miles from Lewistown,	John A. Wright & Co.		H.	1,069	729	100	67	"	1	2½ 3		8⅓	32.4	"	2, 3	E.	1,200
do.	1848 S		1	1846	Malinda,	Orbisonia,	Blair & Madden,		H.	350		30	20	"	1	2½		6½	28	"	2, 3	"	800
do.		1		1829	Paradise,	Paradise Furnace,	H. Trexler & Co.		¾ F. & ¼ H.	700	560	35	24	"	2	2		7½	33	"	2, 3	"	1,000
do.	1849 S		1	1838	Jackson,	McElavey Fort,	Mitchell, Vance & Alexander,		F.	350		30	18	"	1	2		6	20	"	3	"	800
Lehigh, . .	1850 S		1	1800	Hampton,	Lionsville,	Seyfert, McManus & Co.		H.	650		46	26	"	1	2		9	32	"	2, 3	"	800
Lycoming, . .		1		1838	Heshbon,	Newberry,	Wm. McKinney,		H.	550	400	30	30	"	1	2		6.9	25	"	3	E. & H.	900
do.			1	1820	Pine Creek,	Jersey Shore, 4 m.	J. Vickers,		F.	1,000		60	36	"	1	2		8	30	"	1, 2	H.	1,100
Lancaster, . .		1		1785	Mount Hope,	Mount Hope,	E. & B. Grubb,		M.	1,434	1,434	57	48	"	1	2		6½	27	"	1, 2	E.	1,434
do.			1	1816	Lancaster,	Lancaster,	George Ford,		H.	500	300	16	4	"	2	2½		7½	33	Steam.	2, 3	"	1,000
Lebanon, . .		1		1745	Cornwall,	Cornwall,	R. W. Coleman,		M.	1,405	750	60	46	"	1	2		7½	30	S &W.	1	"	1,400
do.		1		1745	Colebrooke,	Elizabethtown, Lancaster Co.	Wm. Coleman,		M.	1,600	1,400	60	60	"	1	2		9	30	Water.	1	"	1,600
do.			1	1837	Monroe,	Fredericksburg,	Jonathan Seidel,	Seidel & Thompson.	M.	500		40	25	"	1	2		7	30	"	1	"	900
Mifflin, . .			1	1830	Marion,	Perryville,	W. & T. Reed,		H.	1,800		80	35	"	1					"	2, 3	"	1,800
Montgomery, .			1	1836	Green Lane,	Sumneytown,	Wm. Schall,		H.	450		50	18	"	1	2½		7.4	33	"	2, 3	"	900
Northumberland,	1848 S		1	1847	Paxinas,	Paxinas,	Taggert & Co.		F.	300	300	35	12	"	2	2¼		8	30	"	3	"	1,100
Perry, . .	1841 S		1	1833	Caroline,	Bailysburg,	James Bailey,		F.	750	166	40	10	"	1	2½		9	25	Steam.	3	"	1,400
do.			1	1830	Oak Grove,	Landisburg,	Thudium & Co.		F. & H.	800		50	12	"	1			8		Water.	1	"	1,100
Schuylkill, .			1	1840	Jefferson,	Schuylkill Haven,	David Potts,		M.	700		40	15	"	1			6½		"			800
	27	27	33							52,231	29,697	3,185	1,830										69,524

:A, in the year 1850.

	o. im- ers.	Largest Product. Tons.	Actual make 1849.	Form in which Iron leaves the Works.	Men and boys employed.	Horses, mules and oxen employed.	MARKET.
	1	10	10	Bars.	6	2	Home.
Carb	1	65	65	"	25	12	"
"	1	80	80	"	12	8	"
"	1	40	40	"	12	4	"
"	2	280	100	"	30	12	"
Monr	1	70	40	"	12	2	"
North							
	7	545	335		97	40	

uced. The average annual capacity is 50 tons per fire, which,
Th
for th

belonging to either of the other classes.

st et C	No Furnaces running, 1850. Pud-dling	Heat-ing.	Men and boys employed.	Horses, mules and oxen employed.	Description of Iron made.	Kind of Power employ'd.	Actual make 1849.	Capacity.
)			14	3	Axles.	Steam.		600
Berk)			25	6	Blooms.	"		800
Cum		1	7	1	Steel plates.	"		1000
Phil			13	2	Saw plates.	"		600
)		1	59	12				3000

A Detailed Statement of all the BLOOMERY FORGES IN EASTERN PENNSYLVANIA, in the year 1850.

COUNTY.	Sold by Sheriff, or failed.	Date of construction.	NAME OF WORKS.	SITUATION. P. O.	OWNERS.	LESSEES.	Kind of Power employed.	No. Bloom'y fires.	No. Hammers.	Largest Product. Tons.	Actual make 1849.	Form in which Iron leaves the Works.	Men and boys employed.	Horses, mules and oxen employed	MARKET.
Carbon,		1830	Maria,	Lehighton,	T. M. Smith and Est. of Richards,	None.	Water.	2	1	10	10	Bars.	6	2	Home.
"		1848	Pine Run,	do. 5	J. & D. Lowrey,	"	"	1	1	65	65	"	25	12	"
"		1820	Ashland,	Lehigh Gap, 7	J. J. Albright,	"	"	2	1	80	80	"	12	8	"
"		1843	Anthony's,	do. 7½	N. Anthony,	"	"	2	1	40	40	"	12	4	"
Monroe,		1829	Analomink,	Stroudsburg,	John Jordan, Jr.,	Jas. Bell, Jr.	"	3	2	280	100	"	30	12	"
Northampton,	1847 F	1805	Jacobsburg,	Jacobsburg,	A. Benade,	C. E. Benade.	"	2	1	70	40	"	12	2	"
								12	7	545	335		97	40	

These six works all use the rich Magnetic Ores from New Jersey, and consume about 3 tons of ore and 15 cords of wood to the ton of bars produced. The average annual capacity is 50 tons per fire, which, for the 12 fires in the State, would give 600 tons of bars, consuming 9000 cords of wood, and 1800 tons of ore.

A Detailed Statement of the FORGES IN EASTERN PENNSYLVANIA, in the year 1850, not properly belonging to either of the other classes.

COUNTY.	Sold by Sheriff, or failed.	Date of construction.	NAME OF WORKS.	SITUATION. P. O.	OWNERS.	No. Puddling Fur.	No. Heating Fur.	No. forge fires.	CONSUMED. Bitum's Coal. Tons.	Anthra'e Coal. Tons.	Wood. Cords.	Pig. Tons.	Bloom. Tons.	Scrap. Tons.	Largest Product Tons.	No. Furnaces running, 1850. Puddling	Heating.	Men and boys employed.	Horses, mules and oxen employed.	Description of Iron made.	Kind of Power employ'd.	Actual make 1849.	Capacity.
Berks,	1848 S.	1846	Reading,	Reading,	A. Taylor,		2			1000			450		400			14	3	Axles.	Steam.		600
Cumberland,	1849 S	1818	Holley,	Papertown,	F. & M. Bank, Philada.,	2	1			800		1000			10			25	6	Blooms.	"		800
Philadelphia,		1849	Kensington,	Kensington,	J. Rowland & Co.		1		600				500	100			1	7	1	Steel plates.	"		1000
"		1850	Oxford,	Frankford,	W. & H. Rowland,			3			1500			1000				13	2	Saw plates.	"		600
						2	4	3	600	1800	1500	1000	950	1100	410		1	59	12				3000

A Detailed Statement of the CHARCOAL FORGES IN EASTERN PENNSYLVANIA in the year 1850.

COUNTY	Sold by Sheriff, or failed, and date.	Kind of Power used.	Date of construction.	NAME OF WORKS.	SITUATION. P. O.	OWNERS	LESSEES	No. forge fires	No. Hammers	Largest Product Blooms. Tons.	Largest Product Bars Tons.	Actual make in 1849. Blooms Tons	Actual make in 1849. Bars. Tons	No. men and boys employed	No. oxen, horses and mules employed	Market *	Run out fires.
Bedford,	1847 S	Water.	1800	Hopewell,	Hopewell,	McDowell, Benedict and others,		4	2	175	75			30	15	H. & E.	1
do.	1848 S	"	1808	Lemnos,	"	Thos. King & Co.		4	2	50	200			39	12	"	1
do.		"	1813	Bedford,	"	Swope, Kings & Co.		5	2	120	281			45	20	H. & W.	
Berks,		"	1788	Rockland,	New Jerusalem,	Abm. De Turk,		1	1		61		30	8	3	H.	
do.		"	1803	Dale,	Dale,	David Schall,		3	2	100	104	15	95	16	11	"	
do.		"	1799	Mount Pleasant,	Dale,	A. B. Bechtel,		2	1		95		95	14	8	"	
do.	1842 S	"	1837	Franklin,	Reading,	J. & H. Thompson,		2	1	230		150		14	8	"	
do.	1848 S	"	1770	Green Tree,	"	John W. Burkhart,		2	1		250			18	10	"	
do.		"	1836	Exeter,	"	Moyer & Yocum,	G. Moyer,	2	1	270		270		20	12	"	
do.		"	1830	Bloom,	Dale,	Horatio Trexler,		2	1		100		100	15	5	"	
do.		"	1797	District,	Pike Township,	"		2	1		150	150		16	6	E.	
do.		"	1780	Birdsboro,	Birdsboro,	E. & G. Brooke,		3	1	225		150		20	6	H.	
do.		"	1780	Oley Forge,	Oley Township,	Jacob S. Spang,		2	1	200		200		20	12	H. & E.	
do.		"	1825	Dowell,	Robeson,	Jonathan Seidel,		2	2		350		200	20	12	"	
do.	1842 F	"	1749	Charming,	Furnace,	H. P. Robeson & Co.		5	2	750		750		50	20	E.	1
do.		"	1830	Northkill,	Schattlesville,	Joseph Seyfert,		2	1	250		200		30	12	"	
do.		"	1810	Mount Airy,	"	"		2	1	250		200		30	11	"	
do.		"	1809	Speedwell,	"	Nicholas Yocum,		2	1	80	50	60	48	20	6	H. & E.	
do.		"	1825	"	"	Daniel Yocum,		2	1		60		56	20	6	"	
do.	1842 S	"	1790	Rockland,	Rockland Township,	Wm. Herbst,		2	1	150		150		16	6	H.	
do.		"	1795	Spring,	Earl "	Bertolet heirs,	Jacob Snell,	3	2	221		152	50	15	5	"	
do.		"	1800	District,	Pike "	Jacob Deysher,		2	1	150		90		16	4	"	
do.		"	1814	Union,	Albany "	George Reagan,	Wm. & J. Reagan,	2	2		80		25	10	8	"	
do.		"	1846	Gibraltar,	Robeson "	H. A. Seyfert, McIlvaine & Co.		4	2	600		226		26	18	"	
do.		"	1828	Maiden Creek,	Hamburg,	George Merkel,		2	1		100		60	16	11	"	
Blair,		"	1833	Antes,	Birmingham,	G. McCamant,		3	1	110		410		30	18	E. & W.	
do.		"	1833	Cold Spring,	"	John Kratzer,		3	1	131		175		25	20	W.	1
do.		"	1813, 1801	Tyrone, 2 forges,	"	Lyon, Shorb & Co.		12	3	1,543		1,543		60	30	"	
do.		"	1828	Franklin,	Williamsburg,	D. H. Royer,		1	1	600		600		30	15	"	1
do.	1850 F	"	1805	Ætna,	Yellow Springs,	Spang, Keller & Co.		4	1	800		600		30	6	"	1
do.		"	1810	Cove,	Williamsburg,	Royer & Schmucker,		3	1	600		400		30	22	"	1
do.		Steam.	1839	Portage,	Duncansville,	Royer, McNeal & Co.	Royer & McNeal,	3	1	400		300		10	2	E. & W.	
do.		Water.	1816	Maria, 3 forges,	"	Dr. P. Schoenberger,		13	3	1,800		1,800		60	50	W.	1
do.		"	1836	Alleghany,	"	"	E. H. Lytle,	4	1	600		600		75	16	"	1
do.	1850 S	"	1837	Gap,	E. Freedom,	E. F. Schoenberger,		5	1	500		400		35	26	"	1
do.		"	1830	Mary Ann,	Antestown,	John Bell,		4	2	500		400		20	14	"	1
Carbon,		"	1820	Ashland,	Lehigh Gap,	J. J. Albright,		2	1		100		100	12	7	H.	
do.		"	1828	Penneville,	East Penn,	S. Balliet & Co.		4	2		210		50	24	4	"	
Centre,		"	1795	Bellefonte,	Bellefonte,	Valentines & Thomas,		5	1	600		600		21	18	"	
do.	1850 F	"	1792	Rock,	"	Samuel Edmiston,		4	2	400		400		15	6	E.	
do.		"	1800	Milesburg,	Milesburg,	Irvin, McCoy & Co.		5	1	600		400		30	24	H.	1
do.	1843 F	"	1811	Eagle,	"	C. & J. Curtin,		7	1	750		466		21	8	"	1
do.		"	1810	Howard,	Howard,	Irvin, Thomas & Co.		2	1	300				10	6	"	
Chester,		"	1847	Greenwood,	Penningtonville,	M. B. & G. W. Buckley,		3	1	350		350		20	12	"	
do.		"	1792	Hibernia,	Wagontown,	Charles Brooke,		3	1	400		300		16	18	"	
do.	1848 S	"	1806	Pleasant Garden,	N. London ✕ Roads,	Ellis P. Irwin,		4	1	600		250		30	12	"	
do.		"	1785	Mary Ann,	Downingtown,	Wm. Dowlan,		3	2	386		386		22	12	"	
do.		"	1750	Coventry,	Pottstown,	George Christman, Sr.	Christman & Bro.	3	1	325		325		18	6	"	
do.		"	1790	Springton,	Brandywine Manor,	John B. Christman,	Christman & Irey,	3	2	325		325		20	10	"	
Clinton,		"	1837	Washington,	Nittany,	John Henderson,	W. Morris & Co.	1	3	500		450		30	6	E.	
Columbia,	1847 S	"	1824	Catawissa,	Mainville,	G. & R. Shuman,		3	2		100		70	25	6	H.	
Cumberland,	1837 S	"	1830	Laurel,	Carlisle,	Wm. M. Watts,		5	2	500	250	265	127	45	13	H. & E.	1
do.	1847 S	"	1811	Carlisle,	"	Peter F. Ege,		4	2		280		250	36	4	H.	
do.		"	1790	Liberty,	Lisburn,	H. G. Moser,		5	2	550	30	520	30	25	13	E.	
Dauphin,		"	1830	Oakdale,	Elizabethville,	S. & W. Sawyer,		5	2	340	50	340	50	25	12	H.	
do.		"	1850		Dauphin,	Longnecker & Snyder,		3	1					20	8	"	
Franklin,	1849 S	"	1846	Carrick,	Fannettsburg,	N. Kelley,	Witherow & Walker,	2	1	25	75		75	10	5	"	1
do.		"	1790	Soundwell,	Roxbury,	Scheffler & Fleming,		3	2		90		90	10	6	"	
do.		"	1834	Northeast,	Louden,	John Beaver,	Lewis & Bros.	2	1		40		32	13	4	"	1
do.		"	1804	Valley,	"	"	Scheffler & Son,	2	1		50		50	15	6	"	1
do.		"	1832	Warren,	Sylvan,	Bowers' heirs,		3	1	100	50			15	4	H. & E.	1
do.	1842 F	W &S.	1805	Montalto, 2 forges,	Montalto,	H. & H. Hughes,		7	2	300	200	300	200	150	30	H.	1
do.		Water	1830	Caledonia,	Grafenburg,	Thaddeus Stevens,		4	3	28	217	30	200	28	6	H. & E.	1
Huntingdon,		"	1837	Juniata,	Alexandria,	S. Hatfield & Son,		4	1	600		600		20	8	H.	2
do.	1848 S	"	1800	Barre,	"	Joseph Green & Co.		6	2	900		700		40	18	E. & W.	1
do.	1840 F	S &W.	1832	Savage,	Paradise,	John Savage,		8	2	500				50	20	"	2
do.	1818 S	Water.	1812	Malinda,	Orbisonia,	Blair & Madden,		4	2	250	75			20	12	E.	
do.	1850 S	"	1804	Juniata,	Shaver's Creek,	E. F. Schoenberger,		6	1	900		475		30	14	W.	1
do.	1849 S	"	1830	Rebecca,	McElavey Fort P. O.	A. G. Curtin,		3	1	200				27	10	E.	
do.		"	1805, 1809	Coleraine, 2 forges,	Coleraine Forge,	Lyon, Shorb & Co.		7	3	1,031		1,031		45	30	W.	
do.		"	1826	Elizabeth,	" P. O.	Martin Gates,		2	1	300		40		20	12	"	
do.	1848 S	"	1831	"	Water Street,	Isett & Harmsh,		3	1	450		450		20	12	"	1
do.		"	1836	Stockdale,	Spruce Creek,	E. B. Isett,		2	1	305		305		10	7	"	
Lancaster,		"	1795	Brooke,	Gap,	George W. Buckley,		3	1	300		100		30	8	E.	
do.		"	1725	Windsor,	Churchtown,	David Jenkins,		4	2		250		125	30	18	H.	
do.	1850 F	"	1750	Poole,	"	Benjamin Jacobs,	Jamison & Sheaff,	3	2	300		200		25	12	E.	
do.		"	1793	Spring Grove,	Goodville,	S. Jacobs' Estate,	J. & R. S. Potts,	4	2	556		556		29	18	"	
do.		"	1750	Speedwell,	Brickerville,	R. W. Coleman,		3	1		280	300		30	12	H. & E.	
do.		Steam.	1850	Lancaster,	Lancaster,	George Ford,		2	1					8	2	"	1
do.		Water	1828	Colemanville,	"	R. & G. D. Coleman,		4	2	610		564		25	12	"	1
do.		"	1755	Martic,	"	"		3	1	641		497		40	20	"	1
do.		"	1830	White Rock,	Oak Hill,	James Sproul's heirs,	John Alexander,	3	2		230		209	25	12	"	
do.		"	1838	Pine Grove,	"	Enos Pennock,		3	2	400		316		20	18	"	
do.	1842 S	"	1810	Ringwood,	Christiana,	James Sproul's heirs,	Charles Cloud,	3	2	305		305		20	12	"	
do.		"	1810	Sadsbury,	"	"	George Steel,	4	2	150	200	150	200	30	16	"	
Lebanon,		"	1815	Union,	Jonestown,	J. B. Wideman,		4	2		150		150	35	12	"	
do.		"	1795	New Market,	Anville,	Jacob Light,	Longnecker & Early,	5	2	225	125	225	125	45	13	H.	
do.		"	1836	Monroe,	Fredericksburg,	Jonathan Seidel,	Seidel & Thompson,	3	1	300		300		40	12	H. & E.	
Luzerne,		"	1824	Nescopeck,	Berwick,	George Westler,		4	2		200		100	25	12	H.	
Lycoming,		"	1828	Heshbon,	Newberry,	Wm. McKinney,		2	1	300		100		20	12	"	
do.		"	1830	Hepburn,	Trout Run,	A. D. Hepburn,	John Essington,	3	2		140		100	15	4	"	
do.		"	1831	Pine Creek,	Jersey Shore,	J. Vickers,		1	2	100	200			32	12	"	
Mifflin,	1847 S	"	1810	Freedom,	Lewistown,	John A. Wright & Co.		6	2	521		521		50	32	E.	
do.	1849 S	S &W.	1838	Brookland,	Waynesburg,	H. N. Burroughs,		6	1	950				45	12	"	1
Montgomery,	1847 F	Water	1750	Glasgow,	Pottstown,	Rittenhouse & Schall,	H. Potts & Co.	3	2	400		205		25	10	H.	
do.		"	1733	Green Lane,	Sumneytown,	Wm. Schall,		3	2	140	100	80	50	30	9	H. & E.	
Northumberland,		"	1844	Paxinas,	Paxinas,	Leisenring & Wolverton,		2	1	250		200		20	6	"	
Perry,	1847 S	"	1829	Fio,	Duncannon,	Robert J. Walker,		5	2	500				50	20	"	
Philadelphia,		"	1850	Flat Rock,	Manayunk,	M. B. Buckley & Sons,		3	1					25	10	H.	
Schuylkill,		"	1801	Schuylkill,	Port Clinton,	John Schall,	Schall & Taylor,	5	2	283		251	32	35	13	H. & E.	
do.	1841 S	"	1828	Susanna,	"	John Rausch,		3	2	200				30	10		
do.	1841 S	"	1816	Brunswick,	"	Koch, Hammer & Huntzinger,	George Focht,	2	1		60		30	20	8	H.	
do.	1842 S	"	1828	Hecla,	"	Young & Jones,		3	2		150		102	30	10	"	
do.	1840 S	"	1830	Mount Vernon,	"	Ludwig & Ege heirs,		2	1		100			20	8	"	
do.		"	1826	Mount Hebron,	Rarry,	John B. Otto,		3	2		250		250	50	25	"	
Union,	1848 S	"	1827	Berlin,	Hartleytown,	C. & C. Brooke,		1	2	300				50	20	E.	
York,		"	1810	Castlefin,	Castlefin,	R. W. & W. Coleman,		3	2	150	250	150	200	45	24	H. & E.	
do.		"	1770	Spring,	Spring Forge,	"		2	2		223		190	40	25	"	
do.	1842 S	"	1828	Woodstock,	Margaretta,	Hahn & Himes,	Curran, Himes & Co.	3	2		200			45	24	"	
	34							389	168	32,737	6,880	21,319	3,946	3,065	1,377		31

* In the column headed "Market," "E" means Philadelphia; "W" means Pittsburg; "H" means the interior, either at the works or to the country trade.